Vol. 14, No. 15
August 15, 1989

Energy Research Abstracts

Abstracts 30239-33031

OFFICE OF SCIENTIFIC & TECHNICAL INFORMATION
UNITED STATES DEPARTMENT OF ENERGY

The Office of Scientific and Technical Information

The Department of Energy's Scientific and Technical Information Program (STIP) is carried out at many levels within the Department and by its contractor organizations. The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, provides direction and leadership for STIP and serves as DOE's national center for scientific and technical information management and dissemination. Both DOE-originated information and worldwide literature regarding advances in subjects of interest to DOE researchers are collected, processed, and disseminated through the Energy Data Information System (EDIS) maintained by OSTI. The major data bases in this system are available within the United States through commercial on-line systems and to those outside the United States through formal governmental exchange agreements. The current-year records for the major data bases plus a number of specialized data bases are available to DOE offices and contractors through OSTI's Integrated Technical Information System (ITIS). To manage DOE's information resources effectively, DOE's Scientific and Technical Information Program is one of continual development and evaluation of new information products, systems, and technologies.

UNITED STATES DEPARTMENT OF ENERGY
Office of Scientific and Technical Information
Post Office Box 62
Oak Ridge, Tennessee 37831

International Copyright, © U.S. Department of Energy, 1989, under the provisions of the Universal Copyright Convention.
United States copyright is not asserted under the United States Copyright Law, Title 17, United States Code.

Vol. 14, No. 15
August 15, 1989
ISSN: 0160-3604
CODEN: ERABD

Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 13-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.**

Scope

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for on-line searching as records within the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

Availability

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* (regular issues and annual indexes) from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401, FTS 626-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The subscription rate for 24 semimonthly issues is $184.00 for domestic subscribers and $230.00 for foreign subscribers. A single issue costs $27.00, domestic, or $33.75, foreign. Cumulative indexes are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The GPO Stock Number is 661-000-00000-7 and the price is $174.00 for the Volume 13 indexes.

Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

Canada	Japan
Denmark	The Netherlands
Finland	Norway
France	Spain
Federal Republic of Germany	Sweden
Italy	United Kingdom
	United States

The **International Nuclear Information System (INIS)** was established to promote the exchange of information on nuclear science and technology. Its operation is similar to that of the ETDE, with the INIS Secretariat being located in Vienna, Austria. Currently, 75 countries and 14 international organizations are members of INIS. OSTI serves as the INIS national center for the United States.

In the exercise of its rights and responsibilities under the agreements to which it is a party, the **Office of Scientific and Technical Information** both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a data base for on-line retrieval. The data base serves as well for the production of numerous OSTI publications.

How To Read A Citation

The coverage of literature in this publication includes several document types, ranging from technical reports to journal articles to books. The principal data elements included in these citations are:

1. **Abstract number** within volume.
2. **Report number** identification for report-type literature.
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
11. **Number of pages** or page range.
12. **Language** of document if non-English.
13. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
14. **Publisher's name and location** for documents published by a corporate or commercial source.
15. **Sponsoring organization.**
16. **Contract or grant number.**
17. **Secondary identifying number;** may be a conference number.
18. **Conference title, location, and date,** if applicable.
19. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
20. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 **A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas.** Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 16(5): 581-589 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (380-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 **Polarization of fast particle beams by collisional pumping.** Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

GPO Superintendent of Documents
Government Printing Office
Washington, DC 20402

GPO Dep. Available for inspection or interlibrary loan at Government Printing Office regional depository libraries.

INIS *Available only in microfiche.*
INIS Clearinghouse
International Atomic Energy Agency
P.O. Box 100, A-1400
Vienna, Austria

NTIS U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OSTI U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

TO OBTAIN NON-REPORT LITERATURE

Nonreport literature generally is available from the commercial publisher or corporation listed in the citation. These documents may also be available for loan from local libraries. First, check with the local library. Other sources of information are:

Journal articles *Chemical Abstracts Service Source Index (CASSI)* tells which libraries, both U.S. and foreign, contain a journal and the available years. *Ulrich's International Periodicals Directory* contains information on the journal and its publisher. For librarians, another source of information is On-Line Computer Library Center (OCLC), for interlibrary loans.

Books, conferences, and monographs The source for these publications is the publisher or the originating society, organization, or institution. DOE-supported conferences and individual papers reporting DOE-supported research may be available as reports from OSTI.

Foreign material The Linda Hall Library is an excellent source of foreign materials. For translations of foreign language material, contact the John Crerar Library. For material difficult to locate, check with the British Library Document Supply Centre.

On-Line Computer Library Center
6565 Frantz Road
Dublin, OH 43107-0702
614-764-6000

Linda Hall Library
5109 Cherry Street
Kansas City, MO 64110
816-363-4600

John Crerar Library
University of Chicago
5730 S. Ellis
Chicago, IL 60637
312-962-7715

British Library Document Supply Centre
Boston Spa, Weatherby
West Yorkshire
LS23 7BQ
United Kingdom

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 14:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 14:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 14:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 14:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 14:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
14:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
14:17641 DOE/ER/60664–1

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–T1 14:18494 NTIS, PC A03/MF A01 - OSTI E 1.99: DE89007246/JAW MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the data base records.* The following list includes all of the 40 first-level and the 289 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

Numerical Listing of Categories

01 COAL AND COAL PRODUCTS
- 03 Preparation
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Aspects
- 09 Artificial Stimulation
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves, Exploration, and Mining
- 04 Feed Processing
- 05 Uranium Enrichment
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing, Economics, and By-Products
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Safeguards, Inspection, and Accountability
- 60 Legislation and Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies
- 04 Economics

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste and Wood Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power-Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Systems
- 07 Solar Thermal Power Systems
- 08 Ocean Energy Systems
- 09 Solar Thermal Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology and Hydrology of Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope*.

05 Economic and Financial Aspects
06 Environmental Aspects and Waste Disposal
07 By-Products
08 Geothermal Power Plants
09 Geothermal Engineering
10 Direct Energy Utilization
20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
03 Regulations
04 Economics
05 Environmental Aspects
07 Tidal Power Plants
08 Wave Energy Converters

17 WIND ENERGY
01 Availability (Climatology)
03 Regulations
04 Economics
05 Environmental Aspects
06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
01 Power Plants and Power Generation
02 Environmental Control Technology
03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
01 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled
02 Power Reactors, Nonbreeding, Light-Water Moderated, Non-boiling Water Cooled
03 Power Reactors, Nonbreeding, Graphite Moderated
04 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated
05 Power Reactors, Breeding
06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
07 Regulation and Licensing
08 Economics

22 NUCLEAR REACTOR TECHNOLOGY
01 Theory and Calculation
02 Components and Accessories
03 Fuel Elements
04 Control Systems
05 Environmental Aspects
06 Research, Test, and Experimental Reactors
07 Plutonium and Isotope Production Reactors
08 Propulsion Reactors
09 Reactor Safety

25 ENERGY STORAGE
01 Magnetic
02 Compressed Gas
03 Pumped Hydro
04 Capacitor Banks
05 Flywheels
06 Thermal
07 Liquefied Gas
08 Chemical
09 Batteries

29 ENERGY PLANNING AND POLICY
01 Energy Analysis and Modeling
02 Economics and Sociology
03 Environment, Health, and Safety
04 Natural Resources
05 Research, Development, Demonstration, and Commercialization
06 Nuclear Energy
07 Transport and Storage
08 Waste Heat Utilization
10 Conservation
20 Supply, Demand, and Forecasting
30 Policy, Legislation, and Regulation
40 Fossil Fuels
50 Hydrogen and Synthetic Fuels
60 Electric Power
80 Consumption and Utilization
90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION
01 MHD Generators
02 EHD Generators
03 Thermoelectric Generators
04 Thermionic Converters
05 Fuel Cells
08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
01 Buildings
02 Transportation
03 Industry and Agriculture
06 Municipalities and Community Systems
09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
01 Internal Combustion Engines
02 External Combustion Engines
03 Electric-Powered Systems
04 Hybrid Systems
05 Flywheel Propulsion
06 Vehicle Design Factors
07 Emission Control
08 Alternative Fuels

35 ARMS CONTROL
01 Policy, Negotiations, and Legislation
02 Proliferation
03 Verification

36 MATERIALS
01 Metals and Alloys
02 Ceramics, Cermets, and Refractories
06 Other Materials

40 CHEMISTRY
01 Analytical and Separations Chemistry
02 Inorganic, Organic, and Physical Chemistry
04 Electrochemistry
05 Photochemistry
06 Radiation Chemistry
07 Radiochemistry and Nuclear Chemistry
08 Combustion, Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING
02 Facilities and Equipment
03 Lasers
04 Heat Transfer and Fluid Flow
05 Materials Testing
08 Electronic Circuits and Devices
09 Waste Processing Plants and Equipment
10 Combustion Systems
20 Underground Engineering
30 Marine Engineering
40 Pollution Control Equipment
50 Power Cycles

43 PARTICLE ACCELERATORS
01 Design, Development, and Operation
02 Beam Dynamics, Field Calculations, and Ion Optics
03 Auxiliaries and Components
04 Storage Rings

44 INSTRUMENTATION
01 Radiation Instrumentation
02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
03 Miscellaneous Instruments
04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
01 Chemical
02 Nuclear
03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
01 Basic Studies
02 Chemicals Monitoring and Transport
03 Radioactive Materials Monitoring and Transport
04 Thermal Effluents Monitoring and Transport
05 Site Resource and Use Studies
06 Regulations

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
01 Social and Economic Studies
02 Assessment of Energy Technologies

55 BIOMEDICAL SCIENCES, BASIC STUDIES
01 Behavioral Biology
02 Biochemistry
03 Cytology
04 Genetics
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicology
04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

64 PHYSICS I
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS II
10 Nuclear Physics
12-20 Nuclear Properties and Reactions
30 Nuclear Theory
40 Radiation and Shielding Physics
50 Medical Physics
60 Condensed Matter Physics
61 Superconductivity
70 Theoretical and Mathematical Physics

70 FUSION ENERGY
01 Plasma Research
02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

CORPORATE AUTHOR INDEX
PERSONAL AUTHOR INDEX
SUBJECT INDEX
CONTRACT NUMBER INDEX
REPORT NUMBER INDEX
ORDER NUMBER CORRELATION

Alphabetical Listing of Categories

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
35 ARMS CONTROL
56 BIOMEDICAL SCIENCES, APPLIED STUDIES
55 BIOMEDICAL SCIENCES, BASIC STUDIES
40 CHEMISTRY
01 COAL AND COAL PRODUCTS
30 DIRECT ENERGY CONVERSION
20 ELECTRIC POWER ENGINEERING
32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
29 ENERGY PLANNING AND POLICY
25 ENERGY STORAGE
42 ENGINEERING
52 ENVIRONMENTAL SCIENCES, AQUATIC
50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
45 EXPLOSIONS AND EXPLOSIVES
70 FUSION ENERGY
99 GENERAL AND MISCELLANEOUS
58 GEOSCIENCES
15 GEOTHERMAL ENERGY
57 HEALTH AND SAFETY
13 HYDRO ENERGY
08 HYDROGEN
44 INSTRUMENTATION
07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
36 MATERIALS
03 NATURAL GAS
05 NUCLEAR FUELS
21 NUCLEAR POWER PLANTS
22 NUCLEAR REACTOR TECHNOLOGY
04 OIL SHALES AND TAR SANDS
09 OTHER SYNTHETIC AND NATURAL FUELS
43 PARTICLE ACCELERATORS
02 PETROLEUM
64 PHYSICS I
65 PHYSICS II
14 SOLAR ENERGY
16 TIDAL AND WAVE POWER
17 WIND ENERGY

Energy Research Abstracts

01 COAL AND COAL PRODUCTS

0103 Preparation

Refer also to citation(s) 30273, 30280, 30798

30239 (DOE/PC/88883–T2) **Development of the electroacoustic dewatering (EAD) process for fine/ultrafine coal: Second quarterly progress report period ending 31 March 1989.** Battelle Memorial Inst., Columbus, OH (USA). 18 Apr 1989. 10p. Sponsored by DOE Fossil Energy. DOE Contract AC22-88PC88883. Order Number DE89012305/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Battelle, in cooperation with the Electric Power Research Institute (EPRI), Ashbrook-Simon-Hartley (ASH), Kaiser Engineers (KE), Lewis Corporation, and Prof. S.H. Chiang of the University of Pittsburgh, is developing an advanced process for the dewatering of fine and ultrafine coals. The advanced process, called Electroacoustic Dewatering (EAD), capitalizes on the adaptation of synergistic effects of electric and acoustic fields to a commercial belt filter press design that is used in many other applications. The EAD equipment is described. 2 figs.

30240 (DOE/PC/89904–T2) **High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, January 1–March 31, 1989.** Southern Illinois Univ., Carbondale, IL (USA). Coal Extraction and Utilization Research Center. Apr 1989. 117p. Sponsored by DOE Fossil Energy. DOE Contract FC22-89PC89904. Order Number DE89013667/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Research on high-sulfur coal which is taking place at the Coal Technology Laboratory at Southern Illinois University at Carbondale (SIUC) is divided into three general categories: coal science, coal preparation, and coal utilization. The work in these three areas covers a broad spectrum of high-sulfur coal research from the very fundamental aspects of the coal, through its physical beneficiation, to its ultimate utilization. Individual projects are processed separately for the data bases.

0104 Processing

Refer also to citation(s) 30240, 30371, 30372, 31221, 31514

30241 (ACR/CR–YCLQ-5) **Batch autoclave tests for the liquefaction of Alberta subbituminous coals: I.G. Farben liquefaction process.** Moschopedis, S.E.; Hawkins, R.W.; Wasylyk, H. Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept. 1981. 72p. (CE–02433). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

This report presents the results of experiments undertaken to evaluate Alberta's major subbituminous coal deposits as feedstocks for the I.G. Farben liquefaction process. The project results are intended to facilitate optimization of liquefaction conditions, screening coals from the various Alberta deposits and selecting the most suitable for liquefaction using this process. Batch autoclave tests were conducted in a stainless steel magnetically-stirred autoclave (1000 cc) equipped with an internal cooling system for rapid cooling. Three types of Alberta subbituminous coals were evaluated as feedstock, noting especially their percent conversion and production of liquid fuels under predetermined reaction conditions. Process parameters included coal types, temperature, hydrogen pressure, and reaction time. Anthracene oil was used as solvent and ferric oxide as catalyst. The experiments were based on a two level factorial design. The results indicate that Alberta subbituminous coals can be easily converted into liquefaction products with conversion yields in the range of 67 to 95%. 3 refs., 6 figs., 51 tabs.

30242 (ACR/CR–YCLQ-7) **Batch autoclave testing of subbituminous coals of Alberta. Carbon monoxide/steam and dispersed catalyst process.** Gawlak, M.; Carson, D.; Holuszko, M.; Vernon, D. Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept. 1982. 32p. (CE–02434). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Conversion of three reference subbituminous coals of Alberta Highvale, Vesta Mine and Smoky Tower was investigated in CO/steam process at different reaction temperatures. Variants of the process were examined briefly where tetralin replaced anthracene oil, the main solvent, and where hydrogen replaced 80% of carbon monoxide. The same coals were tested in the Dispersed Catalyst (DC) process using sonicly dispersed potassium molybdate (the Dow Chemical catalyst), ferrous sulphate, cobalt sulphate, and an oil soluble iron salt. The experimental program was designed to test the relative ease of solubilization of the coals. All tests were carried out in one l stainless steel autoclaves. The heating rate was approximately 3/sup 0//min for 1.5 hrs. The processing included atmospheric distillation, b.p. up to 190/sup 0/C (water & naphtha), vacuum distillation, 190-420/sup 0/C (gas oil), and pyridine extraction of the distillation residue. Conclusions for the CO/steam process included that optimum conversion temperature is from 380-400/sup 0/C; conversion rates ranged from 84-95%, with 79-94% conversion when the catalyst was omitted; the process yielded a maximum of 2.6% of volatile hydrocarbons; conversion resulted in mainly pyridine soluble involatile product; and 50-60% coal deoxygenation occured during the process. For the DC process, results indicated that potassium molybdate was the most effective catalyst; and that conversion ranged from 90-96% for potassium molybdate and 80-87% for ferrous sulphate. 8 figs., 10 tabs.

30243 (ACR/CR–YCLQ-18) **Liquefaction characteristics of Highvale coal in the Dow Coal Liquefaction Process.** Sands, S.D. Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept. 1982. 13p. (CE–02441). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

This report documents work involving Dow Coal Liquefaction Process trials of a subbituminous coal from the Highvale mine in Alberta. The trials were made using Dow Chemical's 2 lb/d bench scale liquefaction plant, which consists of a reactor section only. Recycle oil for slurry make up was generated by centrifugation as opposed to deasphalting, the patented Dow process for extracting the coal oil from the residue and ash materials in the crude reactor product. Highvale coal is typical of subbituminous coal, with a low carbon and high oxygen content. The ash content is also relatively high. During the initial work, carbon disulfide was used to raise the sulfur content of the feed. Two liquefactions runs were made. The first used deasphalted oil (DAO) as the sole constituent of the slurry makeup oil. The second used centrifuged 150/sup 0/C+ product for 75% of the slurry makeup oil with DAO making up the other 25%. Results indicate that Highvale subbituminous coal can be liquefied in the Dow Coal Liquefaction Process with yields from 53 to 49% depending on the slurry oil used. Conversion was highest using DAO as the only slurry oil component. Use of centrifuged 150/sup 0/C+ oil in combination with DAO in a 3:1 ratio as slurry oil dropped the conversion with the hydrogen uptake falling to 4.98%. 2 refs., 1 fig., 7 tabs.

30244 (ACR/CR–YCPY-5) **Review of the literature on experimental studies of the pyrolysis and hydropyrolysis of coal.** Chambers, A.K. Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept. 1982. 24p. (CE–02442). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

This report summarizes the experimental techniques reported in the literature that have been used to study pyrolysis and hydropyrolysis of coal, including Alberta coals. The review indicates that particle size, heating rate, reaction temperature, residence time, pressure, and surrounding gas all affect the yields of products. Reactor design can also have a major effect on observed yields. An experimental apparatus and method are presented for use in the study of the kinetics of pyrolysis and hydropyrolysis of Alberta coals. An understanding of the pyrolysis process provides guidelines for the design of experimental equipment. An inductively heated screen reactor was assembled to allow rapid testing of samples over the following conditions: gas pressure from vacuum to 140 atm; reaction temperatures from 460 to 1000/sup 0/C; residence time of 0.1 to 20 sec; heating rate of 20 to 10,000/sup 0/C/s; coal particle size from 50 to 1000 μm; and surrounding atmosphere of helium or hydrogen. 12 refs., 7 figs.

30245 (BNL–41390) **Biothermochemical conversion of a bituminous coal.** Sundaram, M.S.; Sundaram, S.K.; Lin, M.; Premuzic, E.T. Brookhaven National Lab., Upton, NY (USA). Dec 1988. 6p. Sponsored by DOE Fossil Energy. DOE Contract AC02-76CH00016. (CONF-890401–12: 197. national meeting of the American Chemical Society, Dallas, Texas, USA, 9-14 Apr 1989). Order Number DE89012223/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Microbial degradation of coal was studied. Exploratory experiments were conducted using Wellmore Kentucky No. 8 bituminous coal, (carbon 77.2%, hydrogen 4.9%, nitrogen 1.5%, sulfur 1.3%, oxygen 6.4% and ash 8.7%), and a microorganism, from the BNL collection, BNL-2-46 strain. The product of interaction of the "as-received" coal and BNL-2-46 strain, a solid, powdery material, after drying, was then pyrolyzed in an inert nitrogen atmosphere to 850°C at a heating rate of 100°C/min in a thermogravimetric apparatus. The microbial treatment with BNL-2-46 strain caused a positive enhancement in total yield to volatiles. At the same time, another organism, BNL-3-25 strain, caused only a minor change in the volatiles yield. 19 refs., 2 figs., 1 tab.

30246 (CONF-860911–33) **Improvement in coal liquefaction solvent quality by dewaxing.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Conoco, Inc., Library, PA (USA). Coal Research Div. 1986. 12p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. From 192. American Chemical Society national meeting; Anaheim, California, USA; 7-12 Sep 1986. Order Number DE89013139/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recycle oils from the Integrated Two-Stage Liquefaction (ITSL), H-Coal and Solvent Refined Coal (SRC) processes were dewaxed by variants of commercial dewaxing processes yielding up to 47 wt % "wax". Dewaxing methods used include the ketone and the urea adduction techniques. The clean waxes are reasonably pure paraffins. The dewaxed oils were substantially better coal liquefaction solvents than the original (non-dewaxed) oils in batch liquefaction tests. For example, in one case, dewaxing improved the conversion of a standard coal to tetrahydrofuran solubles at standard reaction conditions from 71% with the original oil to 87% with dewaxed oil. These data provide a direct indication of the inimical effect of paraffin components on solvent quality. The impact of solvent quality is particularly relevant to two-stage liquefaction, in which thermal first-stage reactions proceed in a recycle solvent. In addition, these results indicate the technical feasibility of dewaxing coal liquefaction recycle oils by commercially available technology to improve solvent quality and to produce a useful by-product. Dewaxing could be applied to any liquefaction process that uses a deashed (preferably distillate) recycle stream. 14 refs., 2 figs., 3 tabs.

30247 (CONF-890509–1) **Coal solubilization by enhanced enzyme activity in organic solvents.** Scott, C.D.; Woodward, C.A.; Thompson, J.E.; Blankinship, S.L. Oak Ridge National Lab., TN (USA). 1989. 28p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. From 11. symposium on biotechnology for fuels and chemicals; Colorado Springs, Colorado, USA; 8-12 May 1989. Order Number DE89012351/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Both oxidative and reductive enzymes can be utilized to enhance coal solubilization in aqueous and organic media. Aerobic solubilization was carried out with oxidases in a relatively polar media while solubilization in an anaerobic environment was conducted with reducing enzymes (dehydrogenase or hydrogenase) in aqueous and in both polar and nonpolar organic media in the presence of hydrogen or a hydrogen donor. Solubilization of some enzymes in organic liquids was enhanced by complexation with polyethylene glycol. Enzyme concentration of 1- to 20-mg/mL was used, and most of the reactions occurred during the first 4 h with up to 85% of the coal solubilized. There was some evidence of coal product inhibition and enzyme deactivation at higher temperatures. 19 refs., 2 figs., 8 tabs.

30248 (CONF-8905142–1-Vugraphs) **Coal solubilization by lower fungi.** Faison, B.D. Oak Ridge National Lab., TN (USA). 1989. 33p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. From Annual meeting of the American Society for Microbiology; New Orleans, Louisiana, USA; 15-18 May 1989. Order Number DE89012493/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Research on microbial coal solubilization is presented. Topics include: model compound studies, coalification, structural models, fungal degradation of recalcitrant substrates, product utilization, and product characterization. (CBS)

30249 (DOE/MC/23087–2667) **Study of ammonia removal in coal gasification processes: Final report.** Krishnan, G.N.; Wood, B.J.; Tong, G.T.; McCarty, J.G. SRI International, Menlo Park, CA (USA). Sep 1988. 92p. Sponsored by DOE Fossil Energy. DOE Contract AC21-86MC23087. Order Number DE89000945/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The objective of this program was to investigate the removal of fuel-bound nitrogen that appears as ammonia and hydrogen cyanide in coal gas in the temperature range 540° to 870°C and the pressure range 1 to 20 atm. Following a comprehensive literature search, catalytic decomposition was selected as the most promising concept. Ten catalysts were tested at two temperatures in three different simulated coal gas streams containing ammonia and hydrogen sulfide impurities. A proprietary nickel catalyst (HTSR-1) exhibited high activity at 800°C and excellent physical stability. An Ir-promoted nickel catalyst (G-65*) had significant activity for removing ammonia in the temperature range 550° to 600°C but physically deteriorated at higher temperature. Other tested catalysts were inferior in performance to these two catalysts. Parametric studies were conducted with HTSR-1 and G-65* catalysts to determine the rate of ammonia removal as a function of temperature, pressure, space velocity, and concentrations of ammonia, hydrogen, and steam. The influence of several other impurities commonly present in the hot gas was studied also. 27 refs., 24 figs., 14 tabs.

30250 (DOE/MC/23126–2644) **Multicycle testing of zinc ferrite.** Gangwal, S.K.; Harkins, S.M.; Stogner, J.M.; Woods, M.C. Research Triangle Inst., Research Triangle Park, NC (USA). Oct 1988. 32p. Sponsored by DOE Fossil Energy. DOE Contract AC21-86MC23126. Order Number DE89000920/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Zinc ferrite is a leading regenerable sorbent candidate for high-temperature desulfurization of coal gasifier gases. 3/16" extrudates of a particular zinc ferrite (T-2465) were subjected to two multicycle tests (Test 1 and Test 2) in a high pressure high-temperature bench-scale fixed-bed reactor. In both tests, simulated KRW gasifier gases were used for sulfidation. In Test 1, the sorbent was mixed with 5 weight percent coal char fines elutriated from the KRW gasifier prior to the testing. The simulated gas for this test contained 15 volume percent steam. In Test 2, the sorbent was tested without fines but in the presence of a simulated gas containing only 5 volume percent steam. Over 15 cycles during Test 1 and 5 cycles during Test 2, the sorbent consistently reduced the hydrogen sulfide (H_2S) concentration to less than 5 ppmv and exhibited no downward trend in sulfur adsorption capacity. However, the sorbent extrudates underwent considerable reduction in strength during both tests. During Test 1, crush strength of the sorbent declined from 4.1 lb/mm to 1.3 lb/mm and some decrepitation occurred. Decrepitation and strength reduction were much more severe during Test 2 as only 30% of the sorbent extrudates remained intact after 5 cycles. Carbon formation

followed by sorbent-carbon interaction is believed to be the primary cause of the strength reduction. 5 refs., 9 figs., 15 tabs.

30251 (DOE/MC/24267–2664) **Industrial market assessment of the products of mild gasification: Final report.** Sinor, J.E. North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center; Sinor (J.E.) Consultants, Inc., Niwot, CO (USA). Jan 1988. 176p. Sponsored by DOE Fossil Energy. DOE Contract AC21-87MC24267. Order Number DE89000941/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The goal of this study is to determine the best available conditions, in terms of market volumes and prices, for the products from a mild gasification facility. A process feasibility study will then have to determine the cost of building and operating a facility to make those products. The study is presented as a summary of the options available to a coal producer for creating added product value. For this reason, three specific coal mines owned by AMAX Inc. were chosen, and the options were analyzed from the viewpoint of increasing the total revenue derived from those coals. No specific mild gasification, or mild devolatilization technology was assumed during the assessment. The analysis considers only product prices, volumes, and specifications. It does not assign any intangible value or national benefit to substituting coal for oil or to producing a cleaner fuel. Although it would be desirable to conceive of a product slate which would be immune from energy price fluctuations, such a goal is probably unattainable and no particular emphasis was placed on it. 76 figs., 75 tabs.

30252 (DOE/PC/70018–22) **Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1, 1986–March 31, 1986.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Conoco, Inc., Library, PA (USA). Coal Research Div. Jul 1986. 116p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. Order Number DE89013123/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Conoco Coal research Division is characterizing samples of direct coal liquefaction process oils based on a variety of analytical techniques to provide a detailed description of the chemical composition of the oils, to more fully understand the interrelationship of process oil composition and process operations, to aid in plant operation, and to lead to process improvements. The approach taken is to obtain analyses of a large number of well-defined process oils taken during periods of known operating conditions and known process performance. A variety of coal liquefaction process oils were dewaxes by variants of commercial processes in order to improve their quality as donor solvents. Twenty-five oils were analyzed from Hydrocarbon Research Incorporated's (HRI) Catalytic Two-Stage Liquefaction (CTSL) Run 227- 27. Ten microautoclave tests were made to "calibrate" the reactivity of our standard coal. Nineteen samples of coal and reaction products of coal and potassium/crown ether, supplied by Purdue University, were analyzed by infrared spectroscopy to derive quantitative and qualitative structural information. 22 refs., 13 figs., 38 tabs.

30253 (DOE/PC/70018–27) **Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Conoco, Inc., Library, PA (USA). Coal Research Div. Nov 1986. 62p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. Order Number DE89013125/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Conoco Coal Research Division is characterizing samples of direct coal liquefaction process oils based on a variety of analytical techniques to provide a detailed description of the chemical composition of the oils to more fully understand the interrelationship of process oil composition and process operations, to aid in plant operation, and to lead to process improvements. The approach taken is to obtain analyses of a large number of well-defined process oils taken during periods of known operating conditions and known process performance. A set of thirty-one process oils from the Hydrocarbon Research, Inc. (HRI) Catalytic Two-Stage Liquefaction (CTSL) bench unit was analyzed to provide information on process performance. The Fourier-Transform infrared (FTIR) spectroscopic method for the determination of phenolics in cola liquids was further verified. A set of four tetahydrofuran-soluble products from Purdue Research Foundation's reactions of coal/potassium/crown ether, analyzed by GC/MS and FTIR, were found to consist primarily of paraffins (excluding contaminants). Characterization data (elemental analyses, ^{1}H-NMR and phenolic concentrations) were obtained on a set of twenty-seven two-stage liquefaction oils. Two activities were begun but not completed. First, analyses were started on oils from Wilsonville Run 250 (close- coupled ITSL). Also, a carbon isotopic method is being examined for utility in determining the relative proportion of coal and petroleum products in coprocessing oils.

30254 (DOE/PC/70018–37) **Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Consolidation Coal Co., Library, PA (USA). Research and Development Dept. Jun 1987. 119p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. Order Number DE89013126/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

In 1986, work under this contract concentrated on support of the liquefaction process development activities of the Advanced Coal Liquefaction Test Facility at Wilsonville, AL, and at the Hydrocarbon Research, Inc., (HRI) process development unit (PDU) in Lawrenceville, NJ, on two potential process improvements for coal liquefaction, and on a stable carbon isotope method for quantifying the separate contributions of coal and petroleum to coprocessing products. The several most-significant results and conclusions obtained under this contract in 1986 are highlighted below. 32 refs., 12 figs., 24 tabs.

30255 (DOE/PC/70018–40) **Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Consolidation Coal Co., Library, PA (USA). Research and Development Dept. Sep 1987. 85p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. Order Number DE89013127/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Consolidation Coal Research and Development is characterizing samples of direct coal liquefaction process oils based on a variety of analytical techniques to provide a detailed description of the chemical composition of the oils, to more fully understand the interrelationship of process oil composition and process operations, to aid in plant operation, and to lead to process improvements. The approach taken is to obtain analyses of a large number of well-defined process oils taken during periods known operating conditions and known process performance. A set of ten oils from Hydrocarbon Research, Inc., Run 1-19 was analyzed to provide information on the performance of Burning Star No.2 mine (Illinois 6) bituminous coal. A set of eleven oils from HRI Runs 1-22 and 1-23 was analyzed to provide information on the performance of a NiW and a FeMo catalyst in the CTSL process. Thirty-two coprocessing products from tests 1 through 16 of the Signal Research/UOP continuous bench unit were analyzed by proton nuclear magnetic resonance (^{1}H-NMR) spectroscopy and Fourier-Transform infrared (FTIR) spectroscopy to explore the possibility of using aromaticity and phenolic concentration measurements to determine the contributions of the coal and petroleum to the product. Eight boiling-point fractions of the products from UOP's 2 1/2 month continuous coprocessing test were analyzed by carbon isotope mass spectroscopy, ^{1}H-NMR and FTIR to determine the contributions of the two feedstocks (Lloydminster resid and Illinois 6 coal) to each fraction. 4 refs., 19 figs., 28 tabs.

30256 (DOE/PC/70018–59) **Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987.** Robbins, G.A.; Winschel, R.A.; Burke, F.P. Consolidation Coal Co., Library, PA (USA). Research and Development Dept. Mar 1989. 92p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. Order Number DE89013128/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Consolidation Coal Research and Development is characterizing samples of direct coal liquefaction process oils based on a variety of analytical techniques to provide a detailed description of the chemical composition of the oils, to more fully understand the interrelationship of process oil composition and process operations, to aid in plant operation, and to lead to process improvements. This

quarter a set of eighty-five oils from the Wilsonville, Alabama, direct coal liquefaction pilot plant was analyzed to provide information on the performance of Illinois 6 and Wyodak coals in thermal/catalytic and catalytic/catalytic operation in close-coupled integrated two stage liquefaction (CC-ITSL) with ash recycle. A set of twenty-one samples from the Lummus-Crest, Inc., coal/petroleum coprocessing program were analyzed for carbon isotope ratios. Eight oils from Wilsonville Runs 252 and 253 were analyzed to assist Southwest Research Institute's work entitled "Magnetic Resonance Instrumentation for Coal Liquefaction". Three oils from Wilsonville Runs 251 and 253 were analyzed on a priority basis for Wilsonville to determine differences in the degree of hydrogenation of the oils. A set of five oils were analyzed for donor solvent properties.

30257 (DOE/PC/70018–60) **Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Consolidation Coal Co., Library, PA (USA). Research and Development Dept. Mar 1989. 88p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. Order Number DE89013129/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Consolidation Coal Company Research and Development Department (Consol R and D) is characterizing samples of direct coal liquefaction process oils based on a variety of analytical techniques to provide a detailed description of the chemical composition of the oils, to more fully understand the interrelationship of process oil composition and process operations, to aid in plant operation, and to lead to process improvements. The approach taken is to obtain analyses of a large number of well-defined process oils taken during periods of known operating conditions and known process performance. This quarter a set of 19 oils and 2 coals from HRI CTSL Runs 0-1 and 0-2 was analyzed to provide information on process performance. These runs were noteworthy in that they were the first tests of Appalachian basin coal in the CTSL process. Solubility fractionation analyses were repeated on oils from HRI CTSL Run 1-27. Forty-six batch liquefaction products, made by Energy International with four different "heavy" solvents in statistically designed test matrices of time and temperature, were analyzed to evaluate the influence of properties on the performance of "heavy" liquefaction solvents. The computer program used to calculate propagation of errors for our work with carbon isotope analyses was corrected. 16 refs., 17 figs., 25 tabs.

30258 (DOE/PC/70018–62) **Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Consolidation Coal Co., Library, PA (USA). Research and Development Dept. Mar 1989. 49p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. Order Number DE89013130/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Consolidation Coal Research and Development is characterizing samples of direct coal liquefaction process oils based on a variety of analytical techniques to provide a detailed description of the chemical composition of the oils, to more fully understand the interrelationship of process oil composition and process operations, to aid in plant operation, and to lead to process improvements. The approach taken is to obtain analyses of a large number of well-defined process oils taken during periods of known operating conditions and known process performance. A set of two feed coals and 45 oils from Wilsonville Run 254 were analyzed to provide information on the performance of these coals in catalytic/catalytic operation in close-coupled integrated two-stage liquefaction (CC-ITSL) with ash recycle. Oils from Wilsonville Run 254 were dewaxed to evaluate any improvement on donor solvent quality. One oil from Wilsonville Run 254 was distillated both at Consol and at Wilsonville using their respective distillation procedures. The distillation fractions were analyzed. Carbon isotope ratios were determined on the two planned feedstocks for Wilsonville Run 255 (Ohio 6 coal and Martin Lake lignite). Three microautoclave tests were made to access the donor liquefaction reactivity of Elkhorn 3 coal. Sixteen microautoclave tests were made to "calibrate" the reactivity of our standard coal. Six microautoclave tests were made with two oils from Wilsonville Run 254 to determine the reproducibility of microautoclave tests as applied to samples containing high concentrations of solids. A series of ten fluid-coker tars, produced by Lummus-Crest, Inc., from coal liquefaction vacuum bottoms, was characterized to evaluate their use as liquefaction recycle oils. 11 refs., 26 tabs.

30259 (DOE/PC/70018–65) **Coal liquefaction process solvent characterization and evaluation: Technical progress report, April 1–June 30, 1988.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. Consolidation Coal Co., Library, PA (USA). Research and Development Dept. Apr 1989. 64p. Sponsored by DOE Fossil Energy. DOE Contract AC22-84PC70018. Order Number DE89013131/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Consolidation Coal Research and Development is characterizing samples of direct coal liquefaction process oils based on a variety of analytical techniques to provide a detailed description of the chemical composition of the oils, to more fully understand the interrelationship of process oil composition and process operations, to aid in plant operation, and to lead to process improvements. The approach taken is to obtain analyses of a large number of well-defined process oils taken during periods of known operating conditions and known process performance. This quarter a set of 2 coals, 10 process oils and 20 catalyst samples from Wilsonville Run 255 were analyzed to provide information on process performance. Petrographic analyses were performed on two ash concentrate samples from Wilsonville Run 254 and on the feed coal for that run (Crooksville Mine, Ohio 6 bituminous) to examine any selective rejection of macerals. A group of tests were performed to examine the oil agglomeration of low-rank coals with coal liquefaction oils as a method for deashing coal liquefaction feedstocks. Coal liquids were identified with which both Texas lignite and Wyoming subbituminous coal were successfully agglomerated and deashed. 17 refs., 11 figs., 16 tabs.

30260 (DOE/PC/70809–T15) **Microbial screening test for lignite degradation: Final report.** Yen, Teh Fu. University of Southern California, Los Angeles, CA (USA). [1989]. 19p. Sponsored by DOE Fossil Energy. DOE Contract FG22-84PC70809. Order Number DE89008184/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Two-step degradation consisting of a chemical modification prior to biodegradation was studied. Chemical modifications such as solvent fractionation, nitrogen enrichment, and CH_3ONa solubilization were applied to primarily destroy the weak bonding between organic acids and the main lignite matrix and enrich the biodegradable portion. Results indicate that microorganisms have to use organic acids existing in the lignite to sustain growth. Evidence that fungus is capable of growing on both raw and chemically modified lignite, while bacteria can grow on only chemical modified lignite where weak bonds have already been destroyed, indicates that fungi are able to locate the site of the weak bond and further break it. The growth of bacteria can be supported by organic acids from lignite, however, it cannot break the weak bonds to release organic acids from the main matrix, resulting in the growth failure of bacteria on raw lignite. Finally, two-step degradation and co-culture biodegradation are suggested for future research. 12 refs., 3 figs., 4 tabs.

30261 (DOE/PC/79818–T1) **Bench-scale co-processing: Quarterly report No. 2, July 1, 1988–September 30, 1988.** UOP, Inc., Des Plaines, IL (USA). 15 May 1989. 13p. Sponsored by DOE Fossil Energy. DOE Contract AC22-87PC79818. Order Number DE89012651/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A major objective of this new contract is to look at alternative catalyst systems of coprocessing which might have lower overall costs. Two prospective new catalyst systems have been evaluated. The first was a molybdenum-based catalyst, designated "K6.2," which was selected from several proprietary Mo candidate systems screened previously. Mo is a more active metal than V and has the potential for achieving equivalent conversions and yields to the V, but at lower concentration levels. The overall economics of this system will depend on whether the Mo is active enough to be used at concentrations so low that it can be used as a disposable catalyst, or whether at equivalent high concentrations to the vanadium, the improvement in product yield and quality is great enough to justify the additional catalyst cost. The second catalyst system evaluated

is a modified vanadium slurry catalyst designated "K2.0." The objective of this catalyst formulation was to reduce recovery costs relative to our standard reference vanadium catalyst (K1) by eliminating certain steps in the recovery process. All of the catalysts tested were screened in our standard autoclave test. 7 refs., 4 figs., 8 tabs.

30262 (DOE/PC/81201–T10) **Microbial removal of organic sulfur from coal: Final report, October 1985–September 1988.** Kilbane, J. II; Maka, A. Institute of Gas Technology, Chicago, IL (USA). Mar 1989. 100p. Sponsored by DOE Fossil Energy. DOE Contract AC22-85PC81201. Order Number DE89009049/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The objective of this project was to develop a microbial culture capable of removing organic sulfur from coal. This objective was successfully achieved; thus (1) bacterial culture, capable of specifically metabolizing sulfur atoms present in organic molecules was developed and (2) using this culture, up to 91% removal of organic sulfur from coal was observed in a bioreactor. 25 refs., 30 figs., 13 tabs.

30263 (DOE/PC/88930–T2) **Bimetallic promotion of cooperative hydrogen transfer and heteroatom removal in coal liquefaction: Quarterly technical progress report, December 1, 1988–February 28, 1989.** Eisch, J.J. State Univ. of New York, Binghamton, NY (USA). Dept. of Chemistry. 1 Apr 1989. 6p. Sponsored by DOE Fossil Energy. DOE Contract FG22-88PC88930. Order Number DE89012585/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The ultimate objective of this research is to uncover new catalytic processes for the liquefaction of coal and for upgrading coal-derived fuels by removing undesirable organosulfur, organonitrogen and organooxygen constitutents. Basic to both the liquefaction of coal and the purification of coal liquids is the transfer of hydrogen from such sources as dihydrogen, metal hydrides or partially reduced aromatic hydrocarbons to the extensive aromatic rings in coal itself or to aromatic sulfides, amines or ethers. Accordingly, this study is exploring how such crucial hydrogen-transfer processes might be catalyzed by soluble, low-valent transition metal complexes and/or Lewis acids under moderate conditions of temperature and pressure. This quarter a detailed study of the Lewis-acid catalyzed hydrogen transfer between aromatic and hydroaromatic hydrocarbons was brought to completion. Hydrogen transfer was observed between such acceptors as α-methylstyrene, mesitylethylene, 1,4-cyclohexadiene and 1,1- diphenylethylene, and such donors as 9,10-dihydroanthracene, 9,10- dihydrophenanthrene and 4,5-dihydropyrene. A parallel study of hydrogen transfer catalyzed by nickel (O) complexes has now been launched and positive results have also emerged. With an eye to future studies on a possible synergistic action of 1:1 Lewis acid- nickel combinations, we have begun the search for coordinative binding between the two components. 13 refs.

30264 (NP–9774564) **Characterisation of novel matrix catalysts and catalyst selectivity control for alpha olefin synthesis on the basis of CO and H/sub 2/.** Schulz, H.; Erich, E.; Gorre, H.; Schuhmann, G. Karlsruhe Univ. (T.H.) (Germany, F.R.). Engler-Bunte-Inst. Bereich 1 - Gas, Erdoel und Kohle; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). Mar 1987. 165p. (In German). Order Number DE89774564/JAW. Available from NTIS (US Sales Only), PC A08/MF A01;1.

α olefins from synthesis gas, to characterize the matrix effect especially by kinetic methods, and to relate the findings to physical and chemical measurements on the catalyst. The composition of iron-manganese catalysts was changed to a large extent, e.g. with regard to the contents of iron and manganese from 100 Fe to 279 Mn up to 100 Fe to 1073 Mn. Medium contents of manganese proved advantageous with regard to yield of organic products and formation of olefins. Evaluation parameters were introduced which allow a quantitative registration of selectivity characteristics. The evaluation parameters which cover the primary selectivity typical of matrix catalysts are of importance for this study. In addition to the synthesis tests, the catalysts were characterized by gas adsorption measurements and Hg-porosimetry as well as SEM pictures and X-ray microanalysis.

30265 (PB–89-168892/XAB) **Thermally initiated carbon-carbon bond-cleavage reactions occurring during coal gasification. Final report, April 1985-June 1988.** Zabransky, R.F.; Stock, L.M. Institute of Gas Technology, Chicago, IL (USA). Dec 1988. 235p. Available from NTIS, PC A11/MF A01.

See also PB–87-216016.

Illinois No. 6 high-volatile bituminous coals were modified by incorporating selected molecules via base-catalyzed alkylation reactions. The modified coals were pyrolyzed on a wire-screen reactor at 700 - 900°C in helium at 0.02 mPa and the reaction products separated into char, tar, and gas. The product distributions showed that char formation is suppressed and tar formation is enhanced by the organic fragments. The results strongly suggest that hydrogen atom abstraction reactions are accompanied by beta-scission reactions to form ethene, propene, butene, and pentene and butadiene. In addition, a rearrangement reaction involving a six-membered ring transition state is invoked to explain the formation of propane and propene. In the pyrolysis of arylalkanes, the radicals formed in hydrogen atom donation reactions undergo an array of beta-scission reactions to form one, two and three carbon atom compounds. Surprisingly, ispso demethylation is a slow reaction in the environment of the coal molecule under these conditions. Finally, in the pyrolysis of the labeled tetralin derivatives, generally, ring contraction coupled with demethylation gives methane. The distribution of labels in the gas suggests that retrocyclo addition reactions play a role in the product formation of ethylene from tetralin-like structures in the coal molecule.

30266 (PB–89-168900/XAB) **Strategy for developing environmental sampling and analysis programs at coal-gasification pilot and demonstration plants. Topical report.** Skinner, F.D. Radian Corp., Austin, TX (USA). Feb 1989. 223p. Available from NTIS, PC A10/MF A01.

This report provides assistance in the development of sampling and analysis programs to obtain the data needed to support environmental permitting and environmental control-system design and evaluation for coal-to-substitute natural gas plants. The approach involved in the development of such a program involves: (1) determining the emission and discharge streams from the plant; (2) deciding which of the species that are likely to be present in these streams will be controlled under major Federal environmental regulations or need to be measured to evaluate the performance of potential environmental control processes; and (3) developing a test plant for obtaining the required data. A step-by-step example is given illustrating how to use the information presented in the report.

30267 Effect of carbon dioxide on the kinetics of the Fischer-Tropsch synthesis on iron catalysts. Yatos, I.C. (Dept. of Chemical Engineering, MIT, Cambridge, MA (US)); Satterfield, C.N. *Industrial and Engineering Chemistry Research (USA)*, 28(1): 9-12 (Jan 1989).

A recently proposed kinetic expression applicable to feed ratios H/sub 2//CO of 0.8 or less correlates the synthesis rate by an equation containing an inhibition term for CO/sub 2/and assumes that water vapor concentrations are too low to offer significant inhibition. Experimental studies here with synthesis gas of H/sub 2//CO ratios of 0.67-0.72 to which CO/sub 2/was added show, in contrast, that CO/sub 2/is relatively inert. The data are well correlated by an equation developed by Huff that contains an inhibition term for H/sub 2/O but not for CO/sub 2/. The authors suggest that the inhibition attributed to CO/sub 2/was instead actually caused by H/sub 2/O formed by the reverse water gas shift reaction.

30268 Concentration and removal of nitrogen and sulfur containing compounds from organic liquids phases using electrochemically reversed chemical complexation. Koval, C.A. (Univ. of Colorado, Boulder (USA)); Drew, S.M.; Spontarelli, T.; Noble, R.D. *Separation Science and Technology (USA)*, 23(12-13): 1389-1399 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

A process is being developed to concentrate and remove sulfur- and nitrogen-containing compounds from organic liquid phases. These phases could include coal liquids, oil from shale or tar sands, as well as conventional crude oil. This process uses reversible complexation and electrolysis. A cyclical contacting scheme is

proposed: the compounds are first extracted from a polluted hydrocarbon phase using an aqueous phase containing a complexing agent; the aqueous phase is then contacted with a waste hydrocarbon phase and the complexing agent is oxidized, releasing any complexed pollutants into the waste hydrocarbon phase. This cycle is repeated to extract more pollutants, i.e. sulfur and nitrogen compounds, from the contaminated phase and concentrate them in the waste phase. A description of the process and preliminary results for one system are presented.

0106 Properties

Refer also to citation(s) 30240, 30252, 30253, 30254, 30255, 30256, 30257, 30258, 30259, 30282, 30372, 30647, 31407

30269 (ACR/CR–YCLQ-10) **Round robin tests, 1982. Petrographic analysis for a high volatile Australian coal and its liquefied residue.** Parkash, S.; Stangl, C.; Holuszko, M. Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept. 1982. 26p. (CE–02429). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

This report consists of petrographic data (reflectance as well as maceral analysis) on a high volatile Australian feed coal and its hydrogenation residue pellet. The report consists extensively of numerical data.

30270 (DOE/PC/80522–T7) **Metal arene complexes in coal structure determination: Quarterly reports, September 1988–February 1989.** Woolsey, N.F. North Dakota Univ., Grand Forks, ND (USA). Dept. of Chemistry. May 1989. 5p. Sponsored by DOE Fossil Energy. DOE Contract FG22-85PC80522. Order Number DE89012704/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The functionalization of diphenyl methane by benzylic alcohol formation via its chromiumtricarbonyl complex has been studied. Reliable benzylic anion formation has been achieved. Oxidation to the benzylic alcohol via the benzylic boronic ester has proven difficult, although a procedure for ring hydroxylation has been developed successfully. Modification of this procedure to insure benzylic alcohol formation is underway. Further work with the chromiumtricarbonyl complex of soluble polybenzyl has shown that basic treatment gave stoichiometric amounts of benzylic anions which were detected by methylation. Preparation of the corresponding insoluble polybenzyl complex has been initiated.

0108 Waste Management

Refer also to citation(s) 30240, 30249, 30250, 30397, 30803, 30804, 30809, 31514

30271 (CONF-8904197–2) **Combined SO_2/NO_x control technologies.** Livengood, C.D. Argonne National Lab., IL (USA). 1989. 33p. Sponsored by DOE Fossil Energy. DOE Contract W-31109-ENG-38. From The energy/chemistry conference; Cairo, Egypt; 1-3 Apr 1989. Order Number DE89012417/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Nitrogen oxides (NO_x) are found in the flue gas from all combustion processes and sulfur dioxide (SO_2) is produced in significant quantities in the combustion of coal and some petroleum products. Available control processes for these pollutants typically involve combustion modification techniques for NO_x and some form of wet scrubbing (usually based on lime or limestone as a sorbent) for SO_2. Recently, catalytic reduction for NO_x control has achieved commercial status in some countries and spray-dryer technology has led to the development of a wet/dry scrubber system producing an easily handled dry waste. Research and development programs are actively working on a wide variety of alternative technologies such as "reburning" for NO_x control, dry furnace or duct injection of SO_2 sorbents, and a number of integrated technologies that remove both SO_2 and NO_x. The latter represents a particularly attractive approach from both a cost and operational point of view, since the number of components is minimized, system operability is enhanced, and reliability is generally improved over that attained with a series of independent technologies. This paper reviews a number of integrated processes that have reached a significant stage of development in the United States. Experiences with these technologies in other countries are noted where such information is available. Each technology is described in terms of operational principles, hardware required, byproducts, and development status. Comments regarding capital and operating costs, operating experiences, and application guidelines are also provided where possible. 32 refs., 19 figs., 2 tabs.

30272 (DECG–S10-608) **Utilization potential of circulating fluidized bed combustion residue in construction applications. Final report.** Dearborn Environmental Consulting Group, Mississauga, ON (Canada). 1988. 57p. (MICROLOG–89-01752). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Atmospheric Fluidized Bed Combustion (FBC) is gaining acceptance for the combustion of high sulfur content solid fuels. Crushed fuel and limestone are suspended in the combustion chamber by fluidizing air. The limestone is calcined to CaO, which combines with the SO/sub 2/released during combustion and with oxygen to form calcium sulfate. The need for a flue gas scrubber is therfore eliminated. Circulating FBC is a recent development which is particularly suited to large scale applications. The literature regarding the theory and chemistry of cementitious materials, the characterization of the Chatham, New Brunswick circulating FBC residue as to chemical composition and particle size, and the materials testing program is reviewed. The results have demonstrated that there are significant differences in bubbling and circulating FBC ashes and in their performance in no-cement concretes. Most notable are the lime availability and very fine particle size distibution. These result in low amounts of cementitious components and poor workability. Compressive strength development and setting time are therefore adversely affected. The design and performance of atmospheric FBC no-cement concretes appear to also be very dependent upon the characteristics of the ashes used, the highly glassy, high silicon and aluminum content Kingston ashes giving better results than the low glass, course, high iron content Dalhousie ashes. 17 refs., 8 figs., 21 tabs.

30273 (DOE/PC/81582–T1) **Dewatering of fine coal refuse: Final report, August 1985–December 1987.** Chiang, Shiao-Hung; Klinzing, G.E.; Morsi, B.I.; Tierney, J.W.; Badgujar, M.; Cheng, Yisun; Fang, S.R. Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering. Jan 1988. 189p. Sponsored by DOE Fossil Energy. DOE Contract AC22-85PC81582. Order Number DE89009081/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

A major area of concern in modern coal preparation plants is the filtration and dewatering of fine coal/refuse. Fine coal in slurry form must be dewatered to minimize handling and transportation problems and to maximize its calorific value. The main emphasis of the present work is on the study of enhanced dewatering of fine coal and refuse using vacuum, air pressure and vacuum plus pressure expression (using a belt filter press) techniques. The objective of the study is to seek improved methods of dewatering through a better understanding of filtration and post-filtration processes. Coal refuse obtained from a southwestern Pennsylvania mine and coal samples obtained from several different sources were used in this study. The effects of a number of surface active agents and flocculants on filtration and dewatering of the coal and refuse were studied. Porosity and single phase permeability data were obtained along with the micrographic analysis of the filter cakes. In the case of pressure expression by belt filter press, the effects of belt speed and applied hydraulic pressure were studied. 34 refs., 85 figs., 9 tabs.

30274 (DOE/PC/88874–T3) **Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 3, January 1, 1989–March 31, 1989.** Acurex Corp., Research Triangle Park, NC (USA). Environmental Systems Div. 27 Apr 1989. 81p. Sponsored by DOE Fossil Energy. DOE Contract AC22-88PC88874. Order Number DE89012306/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Bench-scale experiments have been conducted to measure the mass transfer and kinetic rates at simulated duct injection conditions. Section 2 summarizes tank reactor test results. The stirred tank reactor was designed to simulate the gas/liquid interface of a slurry droplet exposed to SO_2. The test results will be used to estimate the relative gas phase and liquid phase mass transfer resistance for in-duct slurry injection flue gas desulfurization. Preliminary measurements were made at 25°C for gas film mass transfer coefficient during this reporting period. Experimental results from a differential reactor are presented in Section 3. Mississippi hydrated lime was tested for reaction times ranging from 10-120 s. A Short Time Differential Reactor (STDR) has been constructed for mass transfer experiments. Gas/solid reaction rates at duct dry sorbent injection conditions were measured in the STDR. Section 5 reports the progress slurry injection computer modeling. The computer code for the SO_2 absorption—$Ca(OH)_2$ dissolution—$CaSO_3$ crystallization process has been developed. Preliminary results are presented to illustrate the effects of $Ca(OH)_2$ reactivity and concentration on relative gas/liquid mass transfer resistance. 12 refs., 26 figs., 9 tabs.

0109 Environmental Aspects

Refer also to citation(s) 30280, 30741, 30806, 31041, 31918, 32025

30275 (DOE/SR/18001–2) **Development of critical life stage assays: Teratogenic effects of ash basin effluent components on freshwater fish, gambusia affinis and daphnia: Progress report, 21 May 1988–1 June 1989.** Guram, M.S.; Boatwright, B. Voorhees Coll., Denmark, SC (USA). 17 Apr 1989. 22p. Sponsored by DOE Defense Programs. DOE Contract FG09-87SR18001. Order Number DE89012492/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This project will establish a method for describing and evaluating the reproductive level of the Gambusia in the natural state, i.e., non-laboratory establishment of pregnancy. An additional aspect of the overall problem of establishing the natural level of the fertility of free ranging fish has been initiated with the inclusion of another Savannah River Plant (SRP) pond, (Par Pond), and three non-SRP ponds (Edgar Brown Pond, Lebby's Pond, Duncan's Pond) to the previously studied ponds (Ash Basin and Risner Pond). It is necessary to have a wider range of environments than that provided by a single comparison, e.g., Ash Basin versus Risher Pond, to be able to evaluate any one ponds' effect on the life phase of the Gambusia. To begin one of the major objectives of the research project proposal, the investigators have ordered embryonated eggs of the Medaka fish from a commercial source. Even though the Gambusia is a live bearer and the Medaka is an egg bearer, these latter fish eggs will allow the investigators to begin to learn the approximate magnitude of concentrations of inorganic (and possibly organic organic) substances to add to the developing embryonic system in order to study their effects on either the egg-enclosed embryo or the female fish-enclosed embryo. Obviously, the two systems are significantly different but it is anticipated that interesting information will be obtained from a comparison of results in the two systems. 9 figs., 1 tab.

30276 (NBNRE–88-7) **Reclamation options for abandoned commercial peatlands.** Daigle, J.-Y.; Arseneau, A.; Gautreau-Daigle, H. New Brunswick Dept. of Natural Resources and Energy, Fredericton, NB (Canada). Minerals and Energy Div. 1988. 203Pp. (In English and French). (MICROLOG–88-05680). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objectives of this study are to complete a comprehensive bibliographic search on the possible uses of commercial peat bogs, after the sphagnum peat reserves are exhausted, and to identify options for applied research projects. The conversion of cut-over peat bogs for the production of vegetables, fodder, cereals and small fruit is discussed. Reclamation efforts have also been concentrated on forestry for biomass and lumber production. More and more, social pressures require the regeneration and renaturation of abundant sites. Different approaches are presented, including lake formation and the use of abandened pits for fish breeding. A description of the regulations in effect in Minnesota, as well as some recommendations related to the situation in New Brunswick, complete the study. An annotated bibliography is included. 83 refs., 3 figs., 4 tabs.

0110 Reserves and Exploration

30277 (MU/B–8804) **Peatland inventory of Manitoba. 3. Interlake region using Landsat v thematic mapper.** Dixon, R.; Stewart, J. Manitoba Univ., Winnipeg, MB (Canada). Dept. of Botany. 1988. 28p. (MICROLOG–89-00082). Available from Manitoba Legislative Library, 200 Vaughan St., Winnipeg, MB, Canada R3C 1T5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The vegetation cover, areal extent and quality of Manitoba peatlands were surveyed to aid in determining their potential for fuel, horticulture, agriculture, and forestry. A supervised classification was applied to Landsat-V data of the east central area of the Interlake region of Manitoba. The spectral and spatial heterogeneity of vegetation cover types generated useful signatures of the bog class with high quality horticultural grade sphagnum peat. Detailed botanical surveys and peat depth correlations were limited because of financial constraints. From this thematic mapper study it is predicted that the confidence level for mapping the commercially viable peat deposits range from sphagnum ericoid bogs>ericoid spahagnum bogs> open canopy conifer with low shrub bogs>closed canopy treed bogs. 12 refs., 9 figs.

30278 (UT–9013434) **Bureau of Economic Geology annual report, 1988.** Texas Univ., Austin, TX (USA). Bureau of Economic Geology. 1988. 77p. Available from OSTI - University of Texas at Austin, Bureau of Economic Geology, University Station, Box X, Austin, TX 78713.

Assessment, quantification, and geologic analysis of the state's vast petroleum and natural gas resources were the focus of new and ongoing research programs conducted during 1988. Primary emphasis was placed on investigation of methods to increase production from older mature hydrocarbon reservoirs. For more than 4 years the Bureau has conducted an integrated geologic/engineering study sponsored by the University of Texas system of remaining mobile oil in selected San Andres/Grayburg reservoirs on University Lands located in the Permian Basin. Analysis of subregional facies geometry, depositional environments, rock fabric/petrophysical properties, and production trends has helped to identify the geologic heterogeneity patterns in these carbonate reservoirs. A three-dimensional computer model of permeability applied to a section of the Dune field on University Lands enabled stochastic simulation of fluid flow and, thus, visualization of the complexity of the reservoir architecture.

0120 Mining

Refer also to citation(s) 30336, 31685, 32063, 32422

30279 (CMRC–82/56-BG) **Thick seam mining methods review of CMRC literature search.** Wright, P.L. Coal Mining Research Centre, Edmonton, AB (Canada). 1982. 75p. (CE–02414). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

This paper provides abstracted references on the methods of mining thick seams used in the world today. The objective of this paper is to assess the possible use of mining methods in the western Canada coalfield. There is provided a subjective interpretation of the likely district productivities of methods described in the papers. A further pertinent comparison is in the methods that are labour intensive, used in areas where there is a large highly trained workforce, and that are used in a non-competitive, highly subsidized economy. A brief summary of mining methods and where they are used is provided. It is concluded that it is unlikely that non-mechanized, or cut and fill, or multi-slice with stowing, or the block system, will have any economic acceptance in western Canada. 65 refs., 1 tab.

30280 (NME–1985) **Fuel peat in Newfoundland.** Mercy Hospital and Medical Center, Chicago, IL (USA). 1985. 15p. (MICROLOG–89-01938). Available from Dept. of Mines and Energy,

PO Box 4750, St. John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This information folder on the availability and use of peat as a fuel in Newfoundland explains the formation of peat, its characteristics, its classifiction depending on degree of decomposition and biological origin, and the location of the main peat bogs in the province. An explanation is given of bog preparation methods and peat harvesting. The fuel characteristics and a comparison with other fuels for energy content, ash content and energy value are given, as well as its use as a fuel in Europe. Environmental aspects are also taken into consideration.

0140 Combustion

Refer also to citation(s) 31221, 31580, 31680

30281 (CONF-890402–6) **Metal wastage in fluidized-bed combustors.** Podolski, W.F.; Reimann, K.J.; Swift, W.M.; Carls, E.L. Argonne National Lab., IL (USA). 1989. 10p. Sponsored by DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 10. international conference on fluidized-bed combustion; San Francisco, California, USA; 30 Apr - 3 may 1989. Order Number DE89013621/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents an overview and status of a cooperative research joint venture on metal wastage in fluidized bed combustors. The participants are the US Department of Energy/Morgantown Energy Technology Center, Argonne National Laboratory, Electric Power Research Institute, State of Illinois Center for Research on Sulfur in Coal, Tennessee Valley Authority, ASEA Babcock, Combustion Engineering, and Foster Wheeler. Tasks are being carried out in three main technical areas: (1) hydrodynamic and erosion modeling (the subject of a separate paper), (2) erosion monitor development, and (3) experimental testing and model validation. The latter two areas are discussed in this paper. 7 refs., 11 figs., 1 tab.

30282 (SAND–89-8235) **Coal Combustion Science quarterly progress report, October–December 1988.** Hardesty, D.R. (ed.). Sandia National Labs., Livermore, CA (USA). May 1989. 70p. Sponsored by DOE Fossil Energy. DOE Contract AC04-76DR00789. Order Number DE89012816/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The objective of this activity is to support the Office of Fossil Energy in executing research on coal combustion science. Specific research for this activity include: coal devolatilization, coal char combustion, and fate of mineral matter during coal combustion. Individual projects are processed separately for the data bases.

0150 Marketing and Economics

Refer also to citation(s) 30995

30283 (CONF-881282–) **Improving public awareness of the importance of coal and clean coal technology.** OPUS Corp., Gaithersburg, MD (USA). May 1989. 176p. Sponsored by DOE Fossil Energy. From Improving public awareness of the importance of coal and clean coal technology; Gaithersburg, Maryland, USA; 12-13 Dec 1988. Order Number DE89012919/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The US Department of Energy (DOE) sponsored a meeting on "Improving Public Awareness of the Importance of Coal and Clean Coal Technology" on December 12-13, 1988 in Gaithersburg, Maryland. The purpose of the meeting was to bring together coal education experts, opinion shapers, and organizations with an interest in coal and coal technology to identify ways to enhance existing public awareness efforts and identify new opportunities to enhance the public's image of coal. The ultimate goal being to educate the public so that they understand that coal and clean coal technologies can be used in an environmentally acceptable manner, while at the same time providing economic and social benefits to society and ensuring the nation's security. Speeches focused on (1) the public's current perceptions about energy and coal, (2) the problems we face from an environmental and media standpoint, (3) current efforts of the coal and mining industries to educate the public, (4) a case study on image changes for the American Forest Institute, and (5) "instruments" to get the message out. Representatives from groups like the National Science Teachers Association, Association of Science-Technology Centers, the US Chamber of Commerce, and public relations firms discussed opportunities for using their organizations as a mechanism in coal awareness efforts. The afternoon sessions that day discussed ways to get messages to audiences such as the general public, industry, educators, students, museums, and the international community.

0160 Health and Safety

30284 (PB–89-162218/XAB) **Pneumoconiosis in Appalachian bituminous coal miners.** Lainhart, W.S.; Doyle, H.N.; Enterline, P.E.; Henschel, A.; Kendrick, M.A. Bureau of Occupational Safety and Health, Cincinnati, OH (USA). 1969. 141p. (PHS-PUB–2000). Available from NTIS, PC A07.

The prevalence of pneumoconiosis among working and nonworking miners in the Appalachian bituminous coal fields, and among working miners and nonminers and their respective wives in two West Virginia communities was surveyed from 1963 to 1965. Coal workers' pneumoconiosis was a serious, widespread problem in Appalachia, with 10% of the working miners and 18% of the nonworking miners exhibiting roentgenographic evidence of the disease. These roentgenographic abnormalities that were definitely related to coal mining and were absent in other workers from the same area were related to duration of mine work and specific mining jobs. Although forced vital capacity was relatively normal in all categories, observed 1-second forced expiratory volume values were depressed in all categories, and the amount of depression was correlated with lung tissue involvement. Miners did not vary appreciably from other workers with regard to work capacity.

0170 Legislation and Regulations

Refer also to citation(s) 31002

02 PETROLEUM

0201 Reserves

30285 (SAND–89-0341) **Oil velocities in the Weeks Island mine during oil recycle exercises.** Webb, S.W. Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 43p. Sponsored by DOE Fossil Energy. DOE Contract AC04-76DP00789. Order Number DE89013331/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As part of the Strategic Petroleum Reserve (SPR), the Weeks Island oil storage site is a converted salt mine that contains approximately 73 million barrels of oil overlying 0.5 million barrels of brine. The oil is contained on two levels of the converted mine which are connected by a number of shafts and openings. Oil recycle exercises are periodically conducted to test the oil fill and withdrawal systems in which oil is simultaneously injected and withdrawn from two different locations in the lower level, and brine may be transported around the lower level of the mine by the movement of the oil. 11 refs., 16 figs.

0202 Geology and Exploration

Refer also to citation(s) 30278, 30289, 30293, 30332

30286 (DOE/BC/14304–T1) **The California Division of Oil and Gas underground injection control program: A peer review.** Underground Injection Practices Council, Oklahoma City, OK (USA). 1989. 118p. Sponsored by DOE Fossil Energy. DOE Contract FG22-89BC14304. Order Number DE89012489/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

In this peer review process, member states of the Underground Injection Practices Council (UIPC), the USEPA and the USDOE have attempted to look at the major ground water protection efforts of state regulatory agencies, their underground injection control (UIC) programs. It is the belief of the UIPC that the national UIC

program represents one of the oldest, largest and perhaps one of the most effective environmental programs to protect our nation's Underground Sources of Drinking Water (USDWs). These programs have been in place for many years. During that time our national commitment to ground water protection and the available technologies to protect it have changed extensively. In light of these changed commitments and new technologies, the UIPC set out to look at the California UIC program. Topics/processes addressed in this report include: permitting, mechanical integrity testing, compliance, plugging and abandonment, inventory/data management, public outreach, and personnel qualifications. (CBS)

30287 (NP–9774580) **Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis.** Schwarzkopf, T. Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen. 13 Nov 1987. 260p. (In German). Order Number DE89774580/JAW. Available from NTIS (US Sales Only), PC A12/MF A01;1.

Bedrock and deposit rock samples (lias epsilon to Dogger beta) from selected sites of the Gifhorn trough (Ruehme, Vorhop Meerdorf) were analyzed by detailed organic-geochemical, mineralogical and sediment-petrographic methods in order to find out about the hydrocarbon genesis, the interdependence between hydrocarbon genesis and sandstone diagenesis, and various geochemical effects during primary and secondary migration. Further, an attempt was made to date hydrocarbon genesis, migration, and sandstone diagenesis within the history of the Gifhorn trough.

0203 Drilling and Production

Refer also to citation(s) 31690

30288 (DOE/BC–88/3) **Contracts for field projects and supporting research on enhanced oil recovery: Progress review No. 55, quarter ending June 30, 1988.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Oil, Gas and Shale Technology; USDOE Bartlesville Project Office, OK (USA). Jun 1989. 115p. Sponsored by DOE Fossil Energy. Order Number DE89000730/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Research programs in enhanced recovery are briefly described. A publications list from the Bartlesville Project Office and an index of the companies and institutions performing the research are included in the report. (CBS)

30289 (DOE/BC/14152–2) **An experimental study to determine the relative influence of fluid-fluid interactions and media heterogeneities on the growth of immiscible viscous fingers.** Stoelzel, D.M. Colorado School of Mines, Golden, CO (USA). 1988. 142p. Sponsored by DOE Fossil Energy. DOE Contract FG22-87BC14152. Order Number DE89013122/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The objective of this research is to evaluate the relative influence of transport media heterogeneities or fluid-fluid interactions on the formation of immiscible viscous fingers. Comparisons of experimental flows in a Hele-Shaw cell show that the spatial variations (heterogeneities) in the glass surface play a more significant role in finger growth than do random fluid-fluid instabilities. Visual records of over two hundred experimental runs were analyzed using digital video image processing and fractal dimension measurements. Digital overlays of the images show that finger patterns sweep essentially the same areas and have the same fractal dimension for different experimental conditions. This shows that heterogeneity in the flow regime is more significant in governing fluid displacements than the mobility controlled instabilities. 27 refs., 35 figs.

30290 (DOE/ER/13083–T3) **Transient liquid crystals in a W/O microemulsion.** Friberg, S.E.; Podzimek, M.; Neogi, P. Missouri Univ., Rolla, MO (USA). 1985. 26p. Sponsored by DOE Energy Research. DOE Contract AC02-83ER13083. Order Number DE89007559/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Preliminary investigations were made to evaluate the potential for W/O microemulsions forming a transient liquid crystalline structure against an aqueous phase. Water poor W/O microemulsions were layered on top of pure water with a weight ratio to give a final transport W/O microemulsion with maximum water content. The results showed the duration of the liquid crystalline layer to depend on the cosurfactant/surfactant ratio and on the hydrocarbon content of the W/O microemulsion. 33 refs., 4 figs.

30291 (DOE/MC/21136–20) **Improvement of CO_2 flood performance: Quarterly report, October–December 1988.** Heller, J.P.; Kovarik, F.S. New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center. 1988. 114p. Sponsored by DOE Fossil Energy. DOE Contract FC21-84MC21136. Order Number DE89012778/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Research on CO_2 injection continued. The following tasks are reported on: (1) Work completed on the improved viscosity correlation, mechanistic modeling of high pressure gas/foam flow, and the effect of free gas on the development of miscibility; and (2) Recent work in three major subareas of the Task II research. The first of these subareas is concerned with rock and reservoir heterogeneity. The emphasis is to consider the effects of non-uniformity on displacement efficiency–both in the reservoir and in laboratory experiments. This work consists both of numerical experiments, in which the effects of large-scale reservoir heterogeneities on production and on tracer diagnostics are calculated, and of the analysis of unique 3-D miscible displacement experiments for the examination of smaller-scale features. Research in the second subarea is concerned with the development of direct thickeners–chemicals that will be soluble in CO_2 or other dense gases and produce polymeric solutions of high viscosity. The work reported here has been concerned with the synthesis of several new types of Method I hydrocarbon polymers. Their principal use in the research is as starting materials for further processing, to synthesize Method II ionomers. In the third subarea, recent developments of interest for the reservoir use of CO_2-foam are presented. It has become apparent that field use of this mobility-control additive can be considered at this time. Not only has our research been able to delineate the mobility decreases that can be expected, and the ranges of surfactant concentration and CO_2 fraction to be used, but it has been possible to define an additional advantage from the use of foam. We report a new measurement that defines the range of permeability over which this effect has been observed in our experiments, and over which it can be expected to be useful in the field. 11 refs., 60 figs., 9 tabs.

30292 (NIPER–385) **Surfactant loss: Effects of temperature, salinity, and wettability.** Noll, L.A.; Gall, B.L.; Crocker, M.E.; Olsen, D.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). May 1989. 56p. Sponsored by DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE89000745/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Adsorption of sodium dodecylsulfate, Triton X-100, decyltrimethylammonium bromide surfactants onto silica gel and Berea sandstone mineral surfaces has been studied as a function of temperature, solution salt concentration, and mineral surface wettability. Adsorption studies using a flow calorimeter were conducted using pure surfactants and minerals. The studies were then extended to the adsorption of one type of commercial surfactant onto both consolidated and crushed Berea sandstone using column techniques. This has allowed the comparison of different methods to evaluate surfactant losses from flowing rather than static surfactant solutions. 20 refs., 15 figs., 37 tabs.

30293 (NIPER–390) **Integrated reservoir assessment and characterization: Final report, October 1, 1985–September 30, 1988.** Honarpour, M.; Szpakiewicz, M.; Sharma, B.; Chang, Ming-Ming; Schatzinger, R.; Jackson, S.; Tomutsa, L.; Maerefat, N. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). May 1989. 336p. Sponsored by DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE89000743/JAW. Available from NTIS, PC A15/MF A01 - OSTI; GPO Dep.

This report covers the development of a generic approach to reservoir characterization, the preliminary studies leading to the selection of an appropriate depositional system for detailed study, the application of outcrop studies to quantified reservoir characterization, and the construction of a quantified geological/engineering model used to screen the effects and scales of various geological heterogeneities within a reservoir. These heterogeneities result in

large production/residual oil saturation contrasts over small distances. 36 refs., 124 figs., 38 tabs.

30294 Modified corresponding states method for predicting densities of petroleum reservoir fluids. Cullick, A.S. (Mobil Research and Development Corp., Dallas, TX (US)); Pebdani, F.N.; Giewank, A.K. *Industrial and Engineering Chemistry Research (USA),* 28(3): 340-347 (Mar 1989).

An essential reservoir fluid property for reservoir engineering, fluid transport design, and reservoir simulation is the fluid density (compressibility factor). The oil density as a function of pressure is normally available from standard laboratory measurements. But in cases of enhanced oil recovery by gas injection or miscible flooding, or in multiphase transport, the dramatic changes in fluid density as a function of concentration and pressure are commonly not measured, and standard correlations are generally inaccurate. Two-parameter equations of state, e.g., Peng-Robinson, and extended corresponding states also predict densities inaccurately for complex reservoir fluids. The authors demonstrate computational improvements and the use of the critical volume as an adjustable parameter to the extended corresponding states principle (ECSP) to improve predictions of petroleum reservoir fluid densities. This new method provides accurate and computationally reliable predictions for complex petroleum fluids. The authors illustrate with five example systems.

0204 Processing

Refer also to citation(s) 30254, 30255, 30256, 30257, 30258, 30259, 30268, 31182, 31430

30295 (BISI–25971) **Corrosion problems in manufacturing liquid fuels in fluidized catalytic (FCC) installations.** Pawlowska, B. Petroleum Refinery Research and Development Centre, Plock (Poland). [1989]. 10p. Available from British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Translated from Polish, Ochr. Przed. Koroz., 1986, (6), p. 133-135.

This article discusses the corrosion problems in manufacturing liquid fuels by crude oil refining in fluidized catalytic cracking (FCC) installations. After describing the mechanism of the corrosion process and the operational disturbances in FCC installations caused by corrosion processes, inspection methods for corrosion in installations are discussed. Finally anticorrosion methods in FCC installations are described including the (1) application of corrosion inhibitors, (2) a washing water supply to the overhead condenser of the fractionating column and (3) polysulphide supply to the washing water. (U.K.).

30296 (PCPP/R–SP88-047) **The degradation study of metals-tolerant fluid catalytic cracking catalyst by molecular probes. Final report.** Surette, D.P. Petro-Canada Products, Sheridan Park, ON (Canada). Research and Development Centre. 1988. 369p. (MICROLOG–89-01731). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A project was proposed in order to develop a means of evaluating stable, metals-tolerant catalytic cracking catalysts using unimolecular compounds as feeds: molecular probes. This would provide a means for assessing residua-processing cracking catalysts so that the reactions that occur during the catalytic cracking of heavy and synthetic crude feedstocks can be better understood and the yields and quality of liquid transportation fuels optimized. The work covered seven special topics in two key areas: the cracking of model feedstocks such as paraffins, other hydrocarbons, major sulfur and nitrogen species, and key component blends; and the effects of major catalyst deactivation mechanisms on regenerated catalyst, hydrothermal deactivation and metals poisoning. Also included were special catalyst pretreatment procedures as well as the determination of physical and chemical properties of catalyst samples. It has been shown that certain traits in the final catalyst mix of zeolite, matrix, and binder are already available in commercial catalysts to some degree. The use of molecular probes together with detailed molecular yields were found invaluable in studying the fundamental cracking behaviours with the added feature of product quality assessment. Feedstock composition was identified as an important parameter in assessing the effects of catalyst deactivation. Similarly, the prediction of cracking yields based solely on feedstock composition data is complex due to the synergistic cracking effects of blending. 40 refs., 216 figs., 52 tabs.

30297 An electrically driven multistage countercurrent solvent extraction device. Scott, T.C. (Oak Ridge National Lab., Oak Ridge, TN (US)); Wham, R.M. *Industrial and Engineering Chemistry Research (USA),* 28(1): 94-96 (Jan 1989).

An electrically-driven, high-surface-area solvent extraction system has been conceived and tested. The system accomplishes droplet formation, coalescence, and phase separation utilizing a single electric field while operating under countercurrent flow conditions. The mass-transport capability of this system has been analyzed by observing the transfer of acetic acid from water (dispersed phase) into methyl isobutyl ketone. Results are reported in terms of the number of theoretical transfer stages per centimeter of column. The emulsion-phase contactor, which has 1.7 stages/cm, outperforms laboratory-scale versions of the York-Scheibel column by a factor of 17 and the Podbielniak centrifugal contactor by a factor of 10. The mass-transfer performance along with the minimal energy requirements of this conceptual device combine to make it an attractive possibility for greatly enhanced solvent extraction operations.

0205 Products and By-products

30298 (AD-A–204073/1/XAB) **Sorption of selected volatile organic constituents of jet fuels and solvents on natural sorbents from gas and solutions phases. Final report, April 1985-September 1987.** Rao, P.S.; Rhue, R.D.; Johnson, C.T.; Oguada, R.A. Florida Univ., Gainesville, FL (USA). Inst. of Food and Agricultural Sciences. Aug 1988. 212p. Available from NTIS, PC A10/MF A01.

Sorption of selected volatile organic constituents (VOC) of jet fuels and solvents on several natural sorbents from the gas and aqueous phases was investigated. The sorbates studied were: trans-1,2-dichloroethylene; 1,2-dichloroethane; trichloroethylene; 1,1,2,2-tetrachloroethane; toluene; ethylbenzene; p-xylene; o-xylene; and cyclohexane. The sorbents used included clays (kaolin, montmorillonite, SAz-1), soils (Webster and Oldsmar), and aquifer materials (Borden and Lula). Sorption from the vapor phase was studied using three techniques; the headspace analysis method, dynamic-flow method, and a gas chromatographic method. Sorption of VOC on anhydrous sorbents and sorbents in equilibrium with water at different relative humidities was examined. The energetics of sorption were characterized by measuring VOC sorption at several temperatures.

0206 Health and Safety

Refer also to citation(s) 30309

30299 (DOE/EH–0089) **Technical safety appraisal of the strategic petroleum reserve, West Hackberry/Big Hill/New Orleans.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). May 1989. 211p. Sponsored by DOE Environment Health & Safety. Order Number DE89012921/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

The Department of Energy (DOE) initiated the development of the Strategic Petroleum Reserve (SPR) in 1976. Since that time, the Department has been involved in a development program to stockpile crude oil in major storage facilities. The SPR facility development program is presently designed to provide a cumulative storage capacity of 750 million barrels and a drawdown/distribution capability of 4.5 million barrels per day. Currently, over 560 million barrels of oil are stored in the SPR facilities. This report presents the results of a multidiscipline Technical Safety Appraisal (TSA) of the SPR operations. The TSA appraised the West Hackberry site where leach and fill operations were being conducted and the Big Hill facility where construction and leaching operations were nearing completion. These sites are considered to be representative of all

SPR operations. Additionally, the TSA appraised the safety related function performed by the New Orleans Project Office of BPS. The SPR storage sites consist of oil storage caverns, wells for leaching and drawdown, raw water intakes and associated piping, oil transport piping and offsite piping, electrical systems, oil metering stations, brine ponds, and associated onsite piping/offsite pipelines and auxiliary equipment, and backup emergency systems and equipment in support of operations. The principal hazards presented in operating SPR facilities are fire, oil spills, occupational safety, and industrial hygiene considerations.

0207 Marketing and Economics

Refer also to citation(s) 30306, 30995, 31004

30300 (DOE/EIA–0524) **Financial aspects of the consolidation of the US oil and gas industry in the 1980's.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 2 May 1989. 31p. Sponsored by DOE Management & Administration. Order Number DE89012563/JAW. Available from NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.

The US oil and gas industry has made adjustments to the decline in oil prices in the 1980's. These adjustments include the reduction of exploration and development activity, the exiting of companies from the market, and the consolidation of the control of oil and gas reserves by the surviving companies. During the consolidation of the US oil and gas industry in the 1980's, purchases of reserves became prominent as a means of replacing oil and gas production among surviving companies. For the 1982 through 1986 period purchases of proved reserves accounted for 35% of US oil and gas reserve additions by the 22 major petroleum companies (and nearly 40% for independent and major companies combined). By contrast, over the 5-year period 1977 through 1981, only 12% of reserve additions by the majors were gained through purchases. (Data for the independents for 1977 through 1981 are not available.) For the 1982 through 1986 period of declining oil prices, surviving companies tended to fall into two distinct groups: those that depended heavily on reserve purchases to augment their US oil and gas reserves (the high purchase group), and those that relied largely on their own exploration and development efforts to replace their US oil and gas production (the low purchase group). This study investigates economic factors associated with the consolidation of the US oil and gas industry by comparing the characteristics and performance of the high purchase and low purchase groups of companies. Two alternative hypotheses are considered as possible explanations of the driving force for the consolidation. 2 figs., 8 tabs.

30301 Changes in business-as-usual forecasts in a petroleum trade model. Lee, R. (Oak Ridge National Lab., TN (USA)); Das, S. *Energy Economics (UK)*, 11(1): 11-32 (Jan 1989).

This paper studies the changes in petroleum trade forecasts that were made in 1986 and in 1987 for 1990 business-as-usual conditions. The forecasts were from a large econometric-linear programming formulation that models crude oil trade between producing and refining regions in the world. The results confirm that not only do oil price forecasts change dramatically from year to year, but that sizeable changes in the forecasted geographical distributions of supply, demand, and trade should also be expected. For planning and policy analysis, it is important to consider this uncertainty in anticipated business-as-usual conditions.

0208 Waste Management

Refer also to citation(s) 30416

0209 Environmental Aspects

Refer also to citation(s) 30299, 32047

30302 (COGLA–8809) **Status of the federal-provincial government response to the West Coast offshore exploration environmental assessment panel report.** Canada Oil and Las Lands Administration, Ottawa, ON (Canada). 1988. 112p. (MICROLOG–89-00360). Available from British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1983, an agreement between the Canadian and British Columbia governments established the basis for a public review of potential environmental and socio-economic effects of renewed offshore oil and gas exploration. A panel was established to hold public inquiries and 92 recommendations were presented in 1986 as a result. This document summarizes the governmental followup to the panel's recommendations, many of which were, or are now, addressed in legislation, regulations and guidelines. Information in this regard is presented with respect to the environmental review process, compensation and liability, seismic surveying, routine exploratory drilling and support operations, socio-economic effects of routine operations, hydrocarbon blowouts, fate and effects of oil in the marine environment, oil blowout contingency planning and countermeasures, and managing for environmental protection. 22 refs.

30303 (DS–096) **Beaufort Sea artificial island erosion data.** Gillie, R.D. Dobrocky Seatech Ltd., Sidney, BC (Canada). 1988. 129p. (MICROLOG–89-01208). Available from Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Results are presented of summer 1986 field surveys to obtain erosion data on an artificial island in the Beaufort Sea. The first survey employed beach profile and echo sounding techniques to successfully obtain three-dimensional data of the island morphology. Short term (daily) cliff erosion was also measured in response to wind and waves from the northeast. An average of 3.4 m of erosion occurred along the exposed side of the island over a two day period. In late August, a succession of storms occurred. During this period the island was severely eroded to the extent that the exposed portion of the island was transformed into a shallow (ca 2 m deep) shoal. The second survey attempt, employing a modified positioning and survey approach, was conducted in September. However, unfavourable weather conditions over the survey period prevented any data being collected. Data from the first survey are presented in the form of tables, profiles, contour plots, and three-dimensional perspective plots. In addition, bathymetric data from a previous survey conducted in 1984 are compared to the results of this survey. Uncertainties in the relative position of the 1984 and 1986 survey origins make it unlikely that reliable estimates of profile change due to sediment transport can be derived. 4 refs., 16 figs., 3 tabs.

30304 (EC/IWD–116) **Development of an oil spill simulation model for the Saint-Lawrence River.** Fingas, M.; Sydor, M. Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate. 1981. 34p. (In French). (MICROLOG–89-00226). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The history of oil spill modelling is reviewed and factors to be considered in plotting the behavior of bunker crude oil on the water surface are summarized. These factors include water currents, winds, tides, waves, and hydrocarbon loss. A model is then developed for the St Lawrence River, starting from Fay's model (1969, 1971) which includes equations for three forces that successively influence hydrocarbons (weight, viscous spreading, and surface tension). Hydrocarbons are represented by a certain number of points, each corresponding to a certain volume, and effects of evaporation, aging and other factors are not considered. Effects of the riverbanks and wind are discussed. An example of a simulation is presented in the case of a spill in the port of Montreal. The model is felt to offer significant advances in oil spill modelling; it is flexible enough to be modified to include factors for evaporation and dissolution of oil, and to supply detailed information on such parameters as speed and direction of a hydrcarbon layer. 32 refs., 9 figs., 1 tab.

30305 (OE–8809) **Air quality survey in the vicinity of the Petro-Canada Trafalgar Refinery, Oakville, Ontario.** Bell, R. Ontario Ministry of the Environment, Toronto, ON (Canada). 1988. 41p.

(MICROLOG–89-01540). Available from Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An air quality survey was garried out using mobile monitoring units in the vicinity of the Petro-Canada (Trafalgar) Refinery in Oakville, Ontario during August and September of 1987. The main aims of this survey were to: monitor during periods of odor, attempt to identify the compounds causing the odors, and compare the results obtained with previous surveys in order to determine the extent of improvement in ground level concentrations of the measured contaminants (particularly total reduced sulfur compounds) after refinery modifications. Sixty-three different monitoring periods comprised this survey, with 79 volatile organic samples and over 500 hours of common contaminant data being collected. From all of these data, none of the applicable air quality standards, criteria, guidelines or provisional guidelines were exceeded for any of the measured gaseous contaminants. During the late summers of 1984 and 1985, air quality surveys were conducted in this same area. This survey was also conducted during late summer, and the comparison of data indicates that the air quality downwind of the refinery has generally improved over the years (in particular the ambient concentrations of volatile organic compounds). However, odor may be still be a problem since significant concentrations of total reduced sulfur compounds and some specific organics were measured during the 1987 survey. When not monitoring downwind of the refinery, the general air quality does appear to have remained essentially the same. 1 fig., 9 tabs.

0210 Legislation and Regulation

Refer also to citation(s) 31000, 31002

30306 (DOE/CH/10381–3) **State uses of Exxon and Stripper Well oil overcharge funds: Status report No. 3.** Gonzales, H. National Consumer Law Center, Washington, DC (USA). c May 1989. 67p. Sponsored by DOE Fossil Energy. DOE Contract FG02-88CH10381. Available from National Consumer Law Center, 236 Massachusetts Ave, N.E., Washington, DC 20002.

This report incorporates information collected by NCLC in telephone surveys conducted from April through mid-May, 1989. As with the previous report, the information we collected on the status and state uses of both Exxon and Stripper Well funds is contained in a series of tables and in the narrative summary section of the report. Section I of the report provides background information regarding the two main sources of oil overcharge funds distributed to the states since 1986 (the Exxon and Stripper Well cases). Section II provides a brief overview of NCLC's findings on the status of state allocation decisions and on specific uses of these funds. Section III of the report, which provides a narrative summary of each state's Exxon and Stripper Well oil overcharge allocations, gives specific examples of some of the programs or projects funded with both these funds, with an emphasis on low-income uses. While information for some states may include all allocations made, the narrative section is not intended to be an exhaustive list of funded projects. Finally, Section IV contains important notes, relating to the series of tables that follow, as well as the tables themselves. 9 tabs.

30307 (SJ–1989) **Report on the terms of reference respecting the inquiry into certain aspects of the Surface Rights Acquisition and Compensation Act, and the board of arbitration for the province of Saskatchewan.** Acton, M.D. Saskatchewan Justice, Regina, SK (Canada). [1989]. 31p. (MICROLOG–89-01458). Available from Saskatchewan Legislative Library, Government Publications, 234 Legislative Bldgs., Regina, SK, Canada S4S 0B3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An inquiry was conducted in Saskatchewan to examine certain aspects of the Surface Rights Acquisition and Compensation Act. Informal meetings were held with surface rights owners and representatives of surface rights organizations and the petroleum industry. Verbal and written submissions were also presented by interested parties. It was noted that surface rights legislation attempts to reconcile two conflicting principles, that property owners have a right to peaceful possession of property and that mineral rights owners have a right to access property. Specific terms of reference of the inquiry included examination of: practices and procedures before the arbitration board that deal with disputes under the Act; changing the wording of the Act to list ancillary machinery and equipment to be placed on a well site; determination of compensation for surface rights; easements for power lines to serve oilfield facilities; right of entry onto private property for the purpose of carrying out surveys; entry fees for the right to enter a property; and the licensing and bonding of landmen engaged in surface rights activities. A number of recommended amendments to the Act are listed. It is concluded that the Act is a fundamentally sound piece of legislation which needs some updating, most of which is a streamlining of the Act but with no real change in substance or procedure.

30308 (SRBM–1988) **Manitoba surface rights board annual report, 1987-88.** Surface Rights Board, MB (Canada). 1988. 22p. (MICROLOG–89-00101). Available from Surface Rights Board, P.O. Box 158, Virden, MB, Canada R0M 2C0; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Manitoba Surface Rights Board is responsible for administering and enforcing the Surface Rights Act, the purposes of which include procedure for acquiring and utilizing surface rights, providing for the payment of compensation, and dispute resolution in connection with surface rights. It also provides for maintenance, preservation and restoration of the surface of land acquired in connection with surface rights. This report provides a summary of the year's activities of the Board in providing for the concerns of both landowners and the oil industry. Highlights of 1987 included a redraft of the Surface Rights Act, a 21% decrease in relation to 1986 in the number of wells drilled, the receipt of about $4 million in rental payments by surface rights owners, and payment of about $1.8 million of municipal taxes on oilfield equipment and pipelines.

0220 Transport, Pipelines, and Handling

Refer also to citation(s) 31236

30309 (TC/MCI–506) **Report of investigation surrounding the cirumstances in which the Canadian oil tanker "L'Orme No.1" heavily struck the Ultramar wharf and the ensuing fire, in Quebec harbour on February 1,1988.** Transport Canada, Ottawa, ON (Canada). Marine Casualty Investigations. 1988. 86p. (In English and Frech). (MICROLOG–89-00464). Available from Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, Canada K1A 0N5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An oil tanker struck a wharf in Quebec City during fog conditions in February 1988, when approaching the wharf in order to pick up a new cargo. A fire broke out immediately, both on the vessel and the wharf. This report describes the background to the accident, the accident itself, the firefighting measures undertaken, an analysis of the weather and fluvial conditions, docking and manoeuvering measures performed by the vessel's personnel, damage to the vessel and wharf, and pollution risk from the accident. A list of factors contributing to the accident is presented. 8 figs.

0230 Properties

Refer also to citation(s) 30252, 30253, 30254, 30255, 30256, 30257, 30258, 30379

30310 (NIPER–264) **Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds.** Steele, W.V.; Archer, D.G.; Chirico, R.D.; Strube, M.M. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Jun 1989. 41p. Sponsored by DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE89000747/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is the first in a series detailing the equilibrium thermodynamics associated with hydrodesulfurization and hydrodenitrogenation reactions for organic compounds present as

contaminants in crude fossil fuels. In this report acyclic and monocyclic aromatic and nonaromatic compounds are considered. Results for nitrogen and sulfur compounds are compared and contrasted using available thermodynamic data from the literature. Details of all calculations are provided, and all data sources are documented. 38 refs., 8 figs., 14 tabs.

30311 (NIPER–319) **Determination of some pure compound ideal-gas enthalpies of formation.** Steele, W.V.; Chirico, R.D.; Nguyen, A.; Hossenlopp, I.A.; Smith, N.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Jun 1989. 81p. Sponsored by DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE89000748/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The results of a study aimed at improvement of group-additivity methodology for estimation of thermodynamic properties of organic substances are reported. Specific weaknesses where ring corrections were unknown or next-nearest-neighbor interactions were only estimated because of lack of experimental data are addressed by experimental studies of enthalpies of combustion in the condensed- phase and vapor pressure measurements. Ideal-gas enthalpies of formation are reported for acrylamide, succinimide, γ-butyrolactone, 2-pyrrolidone, 2,3-dihydrofuran, 3,4-dihydro-2H-pyran, 1,3-cyclohexadiene, 1,4-cyclohexadiene, and 1-methyl-1-phenylhydrazine. Ring corrections, group terms, and next-nearest-neighbor interaction terms useful in the application of group additivity correlations are derived. 44 refs., 2 figs., 59 tabs.

30312 (NIPER–323) **Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Detailed separation and analysis of basic compounds.** Green, J.B.; Green, J.A.; Yu, Shirley K.-T.; Grizzle, P.L. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Jun 1989. 103p. Sponsored by DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE89000746/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Methodology for separation and analysis of basic compounds in petroleum and syncrudes is described. Petroleum bases primarily consist of two general types or compound groups: alkylaromatic species with at least one nitrogen and potentially other heteroatoms incorporated into the aromatic nucleus, and predominantly aliphatic structures containing weakly basic functionalities such as sulfoxide, amide, and other carbonyl-based moieties. Nonaqueous ion exchange liquid chromatography effectively separates these two compound groups. Each compound group is further fractionated into subtypes using an HPLC method employing a silica column and a programmed ternary mobile phase containing propanoic acid. Within each group, compounds elute from the HPLC column in order of increasing basicity. The above also holds for syncrudes, except that aromatic nitrogen types greatly predominate over all weakly basic types and that amino-substituted aromatics are present in addition to azaarene-type structures. The bulk of the report discusses separation strategy, methodology, and results supporting separation selectivity as described above. In addition, nonaqueous titration, infrared, mass spectrometric (MS) and GC/MS techniques for analysis of subfractions are described along with representative results from their application. Limited compositional data from analysis of bases from Wilmington and Cerro Negro petroleums and SRC-II coal liquid are also presented. Prior work in analysis of basic compounds is reviewed and future research direction is addressed. 84 refs., 16 figs., 23 tabs.

30313 (NIPER–395) **High-temperature heat-capacity measurements and critical property determinations using a Differential Scanning Calorimeter: Results of measurements on toluene, tetralin, and JP-10.** Steele, W.V.; Chirico, R.D.; Knipmeyer, S.E.; Smith, N.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Jun 1989. 42p. Sponsored by DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE89000749/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Liquid-phase heat capacities (from near 300 K to near the critical temperature) and critical properties were determined for toluene, tetralin, and the specialty fuel JP-10 with a Differential Scanning Calorimeter (DSC) using high-temperature/high-pressure sample cells and procedural methods developed at NIPER. A complete description of the methods and calculational procedures is included as an appendix to the report. The results for toluene and tetralin compare very favorably with available literature values, while those for JP-10 are the first reported high-temperature heat capacity and critical property measurements for this material. This research was completed to demonstrate the type and scope of measurements needed for materials key to new process development, and in particular to the development of "endothermic fuels" for the development of new High-Speed Flight Vehicles. 20 refs., 5 figs., 21 tabs.

03 NATURAL GAS

30314 (DOE/MC/20422–2677) **US Geological Survey publications on western tight gas reservoirs.** Krupa, M.P.; Spencer, C.W. Geological Survey, Denver, CO (USA). Feb 1989. 133p. Sponsored by DOE Fossil Energy. DOE Contract AI21-83MC20422. Order Number DE89000968/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This bibliography includes reports published from 1977 through August 1988. In 1977 the US Geological Survey (USGS), in cooperation with the US Department of Energy's, (DOE), Western Gas Sands Research program, initiated a geological program to identify and characterize natural gas resources in low-permeability (tight) reservoirs in the Rocky Mountain region. These reservoirs are present at depths of less than 2,000 ft (610 m) to greater than 20,000 ft (6,100 m). Only published reports readily available to the public are included in this report. Where appropriate, USGS researchers have incorporated administrative report information into later published studies. These studies cover a broad range of research from basic research on gas origin and migration to applied studies of production potential of reservoirs in individual wells. The early research included construction of regional well-log cross sections. These sections provide a basic stratigraphic framework for individual areas and basins. Most of these sections include drill-stem test and other well-test data so that the gas-bearing reservoirs can be seen in vertical and areal dimensions. For the convenience of the reader, the publications listed in this report have been indexed by general categories of (1) authors, (2) states, (3) geologic basins, (4) cross sections, (5) maps (6) studies of gas origin and migration, (7) reservoir or mineralogic studies, and (8) other reports of a regional or specific topical nature.

0301 Reserves

30315 (ERCB–ST88-47) **Alberta gas reserve trends.** Energy Resources Conservation Board, Calgary, AB (Canada). 1987. 25p. (CE–02585). Available from Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $N/C.

This publication provides a summary of historical growth rate data for Alberta's gas reserves. At year-end 1987 there were 20,406 gas pools. The average annual growth rate of initial established reserves, due to new discoveries and appreciation of known reserves, for the years 1952 to 1972 was 10/sup 9/m/sup 3//y. From the years 1973 to 1987 the average annual growth rate was 91 x 10/sup 9/m/sup 3//y. Some extraordinary revisions to the reserves during the latter period are listed. Data are presented in tabular formats. 4 figs., 5 tabs.

0302 Geology and Exploration

Refer also to citation(s) 30278, 30286, 30287, 30314

30316 (PB–89-165526/XAB) **Development of gas-bearing reservoirs in the Trenton Limestone Formation of New York. Final report.** Robinson, J.E. Syracuse Univ., NY (USA). Dept. of Geology. Dec 1985. 107p. Available from NTIS, PC A06/MF A01.

The Energy Authority completed a study of the natural gas-bearing potential of New York State's Trenton Limestone Formation. The report includes an analysis of existing gas-well information and geological maps covering 33 counties in western and central New York State. The Trenton Limestone Formation is a limestone

sequence with zones of shale interbeds that, when jointed and fractured, form reservoirs for natural gas. These reservoirs appear to be large and capable of sustained production, providing the production rates are carefully monitored to maintain reservoir pressure. Test wells have shown evidence of natural gas in all areas where the formation is present. The areas with the greatest reservoir potential trend from northeast to southwest beginning near the Adirondack foothills in Oneida County. When reservoir volumes are matched with a high success rate of discovery and minimum drilling costs, the northeastern part of central New York State appears to be the most likely region for both local use and commercial exploration. The Trenton formation in this area of the State generally contains gas at above-normal hydrostatic pressure. This indicates that the gas reservoirs are extensive and reach considerable depths. Due to the geophysical conditions of the reservoirs, however, it is important to carefully manage production and maintain pre-production pressure for optimum gas recovery.

0303 Drilling, Production, and Processing

Refer also to citation(s) 30316

0306 Marketing and Economics

Refer also to citation(s) 30300, 30995, 31074

30317 (BCPC–1988) **British Columbia Petroleum Corporation annual report, 1987-88.** British Columbia Petroleum Corp., Oakville, ON (Canada). 1988. 15p. (MICROLOG–88-05585). Available from British Columbia Petroleum Corporation, 1199 West Hastings St, 6th Floor, Vancouver, BC, Canada V6E 3T5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The British Columbia Petroleum Corporation was established as a provincial Crown agency, whose primary function is to market natural gas produced in the province by purchasing gas from producers and selling it to Westcoast Energy Inc. Westcoast in turn sells it to various domestic utilities and to its principal customer in the USA, Northwest Pipeline. This report summarizes the Corporation's activities for the year ending March 31, 1988 and includes information on gas and sulfur sales and wells completed, as well as financial statements. A highlight of the year was a substantial change in the export market, due to Northwest Pipeline's offer to provide open access transportation service. This conveyed to Northwest's customers the ability to buy gas from other sources, thus increasing competition; as a result, the Corporation's sales, as well as prices received, suffered a severe decline. Sales to the domestic market also declined, reflecting the loss of part of the province's industrial sector to short-term direct sales. 4 figs.

30318 (ERCB–E87128/87-C) **Gas supply and transportation services inquiry.** Energy Resources Conservation Board, Calgary, AB (Canada); Alberta Public Utilities Board, Edmonton, AB (Canada). 1987. 44p. (CE–02584). Available from Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $N/C.

Representatives of both the Alberta Public Utilities Board and the Energy Resources Conservation Board conducted the inquiry into several matters related to the increased market orientation. The inquiry included views of applicants, utilities, producers, marketers, and brokers. Major issues were: the basis for determining classes of consumers to be protected by long-term contracts, terms and conditions of contracts that would ensure long-term security of supply, and the availability of transportation service for natural gas to consumers who wish to contract directly with producers and others for the supply of natural gas. The Boards have concluded that the major element of the public interest under consideration is security of supply for appropriate consumers. The report presents a summary of the Boards' recommendations.

30319 (NEB–23-27) **Natural gas market assessment.** National Energy Board, Ottawa, ON (Canada). 1988. 87p. (MICROLOG–89-01266). Available from National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In a decision dated July 1987, the National Energy Board adopted a market-based procedure to ensure that natural gas licensed for export is surplus to reasonably foreseeable Canadian requirements. As part of this new procedure, the Board monitors the Canadian natural gas market and periodically reports on its current functioning, including the short-term prospects for the supply of and demand for Canadian natural gas. This first short-term report provides a review of the functioning of the Canadian natural gas market and an assessment of the market's performance in satisfying Canadian needs since the introduction of freely negotiated prices; and an assessment of the short-term outlook for the supply of and demand for Canadian natural gas, including an assessment of available pipeline capacity. Also included are a background to the 1985 natural gas agreement, a summary of the regulation of the Canadian natural gas market, a list of the major United States pipelines providing open access transportation, and a glossary of terms. 29 figs., 9 tabs.

30320 (PB–89-167449/XAB) **Feasibility and analysis of fluidic-type devices in gas flow measurements. Final report, March 1987-March 1988.** Williams, D.R. Illinois Inst. of Tech., Chicago, IL (USA). Fluid Dynamics Research Center. Dec 1988. 45p. Available from NTIS, PC A03/MF A01.

See also PB–88-205836.

Extensive experimental investigations of a variety of fluidic flowmeters based on the Coanda principle were conducted in order to find a design suitable for use as a compact residential gas meter. As a result of these investigations a fundamentally different type of fluidic oscillator was invented, which has been named the Trapped Vortex Pair (TVP) flowmeter. The TVP fluidic flowmeter operates over the range of 1.75 cfh to 146 cfh with a pressure drop of 0.59 inches of water and a linearity of plus or minus 3.0%. A much wider range of operation from 0.5 to 200 cfh can be achieved if the pressure-drop constraint is relaxed.

0308 Environmental Aspects

Refer also to citation(s) 30302, 30303, 32047

30321 (GRI–88/0319) **Environmental aspects of rights-of-way for natural gas transmission pipelines: An updated bibliography: Final report, September 1987–June 1988.** Sullivan, B.J.; McGraw, A.C.; Johnson, D.O. Argonne National Lab., IL (USA). Jun 1988. 392p. DOE Contract W-31109-ENG-38. Order Number DE89013596/JAW. Available from NTIS, PC A17/MF A01 - OSTI; GPO Dep.

This bibliography lists over 1,400 references, including books, journal articles, conference and symposium proceedings, government and industrial reports, workshop proceedings, dissertations and theses, and bibliographies. It provides a listing of available literature relevant to the installation of natural gas transmission pipelines and to scientific research on the methods, costs, and environmental aspects of the installation of such pipelines. Also listed are reports on past and current practices of installation and rehabilitation that will be useful to industry members concerned with specific geographic regions. This report will be of use to environmental managers of natural gas companies and to other groups that require information related to the reclamation and maintenance of pipeline rights-of-way. 3 tabs.

0310 Legislation and Regulation

Refer also to citation(s) 30307, 30319, 31000, 31002

0320 Transport, Pipelines, and Handling

Refer also to citation(s) 30318, 31164, 31236

30322 (PB–89-164875/XAB) **Development of a magnetic coating for gas pipe detection. Final report, May 1987-June 1988.** Goodman, W.L. Applied Physics Systems, Mountain View, CA (USA). Jan 1989. 13p. Available from NTIS, PC A03/MF A01.

The inability to accurately locate plastic gas pipe after it is buried has been a troublesome problem since plastic pipe began being used for natural gas distribution. Electromagnetic pipe locaters have been available to the gas industry for decades. However, this technology cannot locate plastic pipe without the use of a metallic wire or tape buried with the pipe. To alleviate this problem, methods of making plastic pipe magnetic were investigated. Magnetic sensors could then be used to detect the presence of the pipe. A number of alternatives were examined, including applying magnetically doped adhesives, paints, and mixtures to the pipe surface. Several options appear to be very promising, but additional research and testing will be required to fully determine the viability of this approach.

0330 Properties

Refer also to citation(s) 30393

0340 Combustion

Refer also to citation(s) 31165, 31222

30323 (PB–89-162390/XAB) **Field evaluation of high-efficiency gas furnaces. Final report.** DeFrees, J.A.; Lints, M.C. Rochester Gas and Electric Corp., NY (USA). Feb 1987. 76p. Available from NTIS, PC A05/MF A01.

This report describes the results of a field test involving an evaluation of six different types of high-efficiency gas furnaces. The sample was selected to represent as many of the new designs as were currently available at the project's outset. The primary objective of the research was to determine the seasonal efficiency for each of these units in a typical installation. Seasonal efficiencies were determined comparing performance to an electrical resistance heater connected in parallel. Efficiencies thus determined were then compared to the rated Annual Fuel Utilization Efficiencies (AFUE). Equipment efficiencies ranged from 80% to 93% and were generally somewhat lower than AFUEs, which ranged up to 96%. An analysis of customer economics for these units also was performed. The study also investigated the codes governing the disposal of condensate from these units.

04 OIL SHALES AND TAR SANDS

30324 (CONF-880589–, pp. 613-620) **Status of oil shale developments and supporting research in Australia.** Alfredson, P.G. (CSIRO, Menai, New South Wales (Australia)); Gannon, A.J. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Although Australia is currently about 80% self-sufficient in petroleum, estimates of future production suggest that there is a 50% probability that this will fall to about 55% throughout the 1990s. Australia's major oil shale resources could be utilized for the production of alternative liquid fuels if economic processes can be developed. Major feasibility studies have been performed for the Condor, Rundle and Julia Creek deposits in Queensland. Latest estimates for the Stuart deposit indicate costs of production, including a return on investment, of US$20 to 30 per barrel of shale oil products. A decision to proceed with a semi-commercial plant based on the Taciuk process is expected late in 1988. Supporting research in Australian government and university research laboratories covers the full spectrum of activities from geology and mining, through retorting and shale oil upgrading to environmental impacts, including process modeling and optimization.

0401 Reserves and Exploration

Refer also to citation(s) 32422

30325 (CONF-880589–, pp. 632-633) **Current situation with respect to oil shale research and the use of oil shale in the Federal Republic of Germany.** Schmitz, H. (Federal Institute for Geosciences and Natural Resources, Hannover (West Germany)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Besides the investigations in Germany the Government of the Federal Republic generously subsidized oil shale exploration in developing countries. BGR geoscientists have carried out geological investigations in Jordan, Thailand, and Turkey. The oil shale of El Lajjun is the best of the analyzed deposits in Jordan for economical utilization. Particularly large scale investigations carried out in Germany with the Lurgi-Ruhrgas method gave excellent results. Geological field work in Turkey ended in December 1987. One oil shale deposit seems to be suitable for commercial purposes. A large sample (about 100 t) is under investigation in the most modern Circofluid fluidized bed system pilot plant of the Vereinigte Kesselwerke (VKW) affiliate of Deutsche Babcock Werke (DBW). Besides these two mentioned German companies the well known Lurgi Company (Lurgi-Ruhrgas-Process) in Frankfurt and the Rohrback Company (Rohrback Process - production of Portland cement) in Dotternhausen are also engaged in oil shale research. Fluidized bed combustion technology is highly suitable for the burning of pulverized fuel with high ash content, like oil shale and is also ecologically harmless. Under these circumstances oil shale is not only of interest as a source of producing oil but as a high quality fuel to produce steam to generate electricity. A very new development by VKW and Babcock is the Circofluid fluidized bed combustion. It is more efficient and ecologically harmless. All types of fuels, such as oil shale, bituminous coal, brown coal, etc. may be burned. Two steam generators with 74 and 100 MW/th are under construction and will be ready this year.

30326 (CONF-880589–, pp. 634) **Oil shale activities in Morocco.** Bekri, O. (Petroleum Moroccan Office, Rabat). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The kingdom of Morocco has conducted since the early seventies, research and development activities on its important oil shale resources. Studies and tested conducted on the two main deposits, Tarfaya and Timahdit, have covered the geological, mining and technological aspects both for the production of oil by retorting through different processes and the production of electricity through direct combustion. This paper gives an overview of these activities and also a summary of data characterizing the Tarfaya and Timahdit oil shale.

30327 (CONF-880589–, pp. 686) **Oil shale in central Jordan.** Hamarneh, Y.M. (Natural Resources Authority, Amman (Jordan)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Known oil shale deposits in central Jordan occur in sedimentary rocks from Campanian to Danian, occurring mainly at El-Lajjun, Jurf Ed-Darawish, Sultani Attarat, Umm Ghudran and Wadi Maghar. They are regarded as rich organic bituminous marls and limestones, which occur at shallow depths extending over an area of approximately 500 km^2. These deposits are uniform in character with an oil yield of 8.3 percent. They contain about 37 billion tons of oil shale with an oil content of 3 billion tons. The geological conditions together with the low mining and infrastructure costs render these deposits quite suitable for industrial utilization.

0402 Site Geology and Hydrology

Refer also to citation(s) 30327, 30334

30328 (CONF-880589–, pp. 25-28) **Geological types of oil shale deposits in China.** Ma, X.; Yin, S. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on

oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Oil shales deposits are widespread and discovered in all provinces and autonomous regions throughout the whole country. They generally occur in the places where tectonic activities are weak. At present, only two deposits are mined as fuel and building materials. The ages of oil shales are from early Silurian to Neogene, the most important is Eogene. In this paper their genetic types are discussed according to the geological characteristics.

30329 (CONF-880589–, pp. 29-33) **Feature of distribution and suggestion on the development and utilization of oil shale in China.** Zhao, L. (Ministry of Geology and Mineral Resources, Beijing (China)); Wang, T. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Oil shales are widely distributed in China. The geological time of the major oil shale deposits of China belongs to the Mesozoic and Cenozoic era. One of the most important characteristics of the oil shale resources in China is the association of coal seams with oil shale beds. Some of the Tertiary oil shales are highly up to 13% in oil yield. The suggestion on the development and utilization of oil shale deposits is put forward.

30330 (CONF-880589–, pp. 34-41) **Geology of New Brunswick oil shales, eastern Canada.** Ball, F.D. (Three-D Geo-Consultants Ltd., Fredericton, New Brunswick (Canada)); Macauley, G. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The stratigraphy, mineralogy, organic geochemistry and organic petrology of three oil shale deposits are discussed. Interpretations are based upon lithologic logs of drill core, bedrock mapping, and inorganic and organic determinations. The interrelationship of the identified oil shale lithotypes and lithostratigraphic units is one of facies change.

30331 (CONF-880589–, pp. 42-50) **Conditions of kukersite deposition.** Puura, V.; Bauert, H.; Mannil, R. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

By detailed stratigraphy and correlation of the borehole sections based on micropalaeontological studies of chitinozoans, conodonts and graptolites, nearly 50 layers of kukersites have been traced in the whole area of their distribution. The kukersite deposition occurred in the northern margin of the shallow carbonate shelf in the internal part of the Middle Ordovician epicratonic Baltic Sea. Kukersites deposited in a rather gentle slope between the marginal hardground zone and the shallow open shelf. It is supposed that the source organic (sapropelic) material appeared in the form of algal mats developed on the extensive hardground tidal flats, from where it was transported by tidal currents and evenly distributed by eastern coastal currents in the adjoining zone. Kukersite-mud accumulated during the regressive stage of the basin development.

30332 (CONF-880589–, pp. 61-72) **Relationship between oil shales and low-matured heavy oil pools in Huanghua depression.** Wang, Z. (Dagang Petroleum Administrative Bureau, Tianjin (China)); Qin, R.; Lei, M. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

This paper presents a comprehensive study for the relationship between the oil shales and developed reservoirs in Huanghua Depression. The study is based on available information, such as sedimentary environment, organic geochemical data, reservoir - forming conditions, etc. In the paper, Dazhongwang - Qijiawu structure is taken as an example. The comparison between heavy oil and the oil shale in this structure suggests that the heavy oil and gas accumulated in dolomitic limestone of the member I, the Oligocene Shahejie Formation of Lower Tertiary come from the oil shales which possess a vitrinite reflectance of 0.3%. The oil shale in the formation is characterized by shallow depth, young age, low metamorphism and good type of kerogen. It had discharged hydrocarbons in great amount before the catagenesis stage was begun and the maturation of kerogen was reached. The low-matured heavy oil and gas mainly come from the heat depolymerized bitumen, but some of them, from direct transformation of organic matter scattered in the oil shales under the catalysis of clay mineral and the reworking of microbe, but may not be the products of kerogen thermal degradation.

30333 (CONF-880589–, pp. 73-84) **Organic geochemistry of the onshore Kimmeridge clay oil shale of Britain.** Williams, P.F.V. (City of London Polytechnic (England)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Results of organic geochemical and petrological studies of oil shales from the UK onshore Kimmeridge Clay (U. Jurassic) are reported. These data indicate a dominantly type II kerogen derived from both allochthonous terrigenous, and autochthonous algal sources. The paper describes the geology, sampling, organic geochemistry, and the deposition environment of the Kimmeridge Clay.

0403 Drilling, Fracturing, and Mining

Refer also to citation(s) 30326, 30414

30334 (CONF-880589–, pp. 51-58) **Commercial zonation of the Estonia oil shale deposit.** Kattai, V.; Puura, V. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

For the commercial zonation of the Estonia oil shale deposit, its area was divided into 4 x 4 km squares. For each square, the means for a set of parameters characterizing the commercial horizon and oil shale quality in the corresponding block were calculated. Statistical analysis revealed regular and strongly correlated changes of the parameters characterizing the thickness and caloric value of the kukersite seams: they have the highest values in the central part of the deposit, decreasing towards the marginal parts. The commercial zonation based on these regularities subdivides the Estonia deposit into three economic regions: (I) central commercial, exploited at present, with the remaining resources for 40-50 years (at the production rate of 25-30 million tons per year); (II) subeconomic part adjacent to central region (40-50 years) and (III) submarginal part.

30335 (CONF-880589–, pp. 584-591) **Preferred explosives for blasting in oil shale mines.** Weiss, E.S. (Dept. of the Interior, Pittsburgh, PA (USA)); Sapko, M.J.; Watson, R.W. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

As part of the Bureau of Mines research into the hazards associated with the mining and processing of oil shale, experimental mine tests have been conducted to evaluate preferred combinations of explosives and inerting materials to prevent ignition of oil shale dust and mixtures of oil shale dust and methane. The relative incendivity of several blasting agents was evaluated in the Bruceton Experimental Mine (BEM). The minimum charge weights resulting in the ignition of predispersed oil shale dust clouds were measured for each of the explosives. A 400 g unstemmed charge of ANFO (ammonium nitrate - fuel oil) was sufficient to initiate an oil shale dust exploration; whereas, a 1000 g unstemmed charge of an emulsion blend did not ignite the dust even with the addition of 4% methane gas. Several stemming materials were evaluated in the BEM for their effectiveness in preventing the ignition of near stoichiometric methane-air mixtures. Water stemming was superior to all other inhibitors tested against methane. The proper selection of explosives

and stemming materials should significantly reduce the probability of secondary dust explosions in oil shale mining.

30336 (GRR–8801) **Demonstration and evaluation of an integrated truck management system in a producing Canadian surface coal or oil sands mine.** Gregg River Resources Ltd., Hinton, AB (Canada). 1988. 108p. (MICROLOG–88-05528). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

During investigations of truck/shovel management systems applicable to surface mines in western Canada, it became apparent than an integrated data collection and truck management system was needed to address the needs of the mining industry. During the investigations, information on data collection and management systems was collected and evaluated. The search was limited to systems that could be directly applied to the trucking operation at surface coal or oil sand mines in Canada, and was restricted to onboard systems. Industry interest in this review of onboard truck management systems led to a cooperative demonstration and evaluation project of an integrated control system on two Euclid R-170 trucks. After evaluation, the Onboard Data Acquisition System (OBDAS) developed by Philippi-Hagenbuch was selected for field trial. The OBDAS system was tested at an Alberta mine from January to November, 1987, where the trucks were used for waste rock haulage. The evaluation of system installation, performance, and reliability is discussed. It was found that instaling OBDAS led to increases in truck productivity, as shown by an increase in average load per cycle. At the present annual waste rock capacity, total cost savings were estimated at $240,000, easily justifying the capital expenditure of $60,000 for system hardware to fit two trucks. In addition to providing measurable production improvements, OBDAS also demonstrated the ability to develop the information base and real time monitoring needed to develop a dispatching system. This report also includes a program listing for the truck management system data collection software, used with a DZ-11 interface on a VAX-11/750. 19 figs., 8 tabs.

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 30268, 30325, 30326, 30380, 30410, 30413, 30414, 31232

30337 (CONF-880589–, pp. 113-119) **Dissociation of organic and mineral matrix of Maoming oil shale at low-temperature and ambient-atmosphere.** Lee, A.S. (Univ. of Southern California, Los Angeles (USA)); Lian, H.J.; Yen, T.F. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

On the basis of the analytical results, the Maoming oil shale sample contains approximately 25.5% kerogen, 1.25% bitumen, 1.2% moisture, and 63.3% ash. Among the mineral content, a semi-quantitative analysis of FT-IR spectroscopic technique indicated that this oil shale is dominant in kaolinite associated with montmorillonite interstratified with illite and amesite as accessories. In an alkaline aqueous environment, the presence of sodium ions can swell the structural layers of clays. The hydroxyl ions can decompose the silicate and alumino-silicate structures, providing that ultrasonic radiation and electrolytic current are applied simultaneously. This results in dissociation of clay minerals and organic complexes. An enrichment of organic matter up to 44.3% can be derived in residual shale from the dissociation process. The dissociation phenomena of organic complexes and mineral matrix are significant. Very likely, it will lead to a new technology for processing organic matter as well as mineral aggregates.

30338 (CONF-880589–, pp. 193-200) **Supercritical extraction of Chinese oil shales.** Guo, S. (Dalian Institute of Technology (China)); Hu, H.; Wang, R.; Han, W.; Huang, G.; Hedden, K.; Wilhelm, A. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

On a semi-continuous installation, eight Chinese oil shales were extracted in nonisothermal experiments with toluene. The relationship between the conversion degree and extract yield in process and volatile matter content and kerogen content of oil shale used was obtained. On the basis of experiments, kinetic treatment of extraction process was made and the relationship between kinetic parameters and volatile matter and kerogen content of oil shale used was also obtained.

30339 (CONF-880589–, pp. 208-215) **Liquefaction of oil shales in different solvents and reagents.** Luik, H.; Klesment, I.; Teder, J. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

In order to obtain liquid product in higher yield, oil shales from different regions of the USSR and other countries (organic content 20-90%) were liquefied. Supercritical gas extraction (SGE) was carried out at 573-673K in low boiling solvents (hydrocarbons, alcohols) and their mixtures with water, as well as in the presence of a series of reagents. Almost complete conversion of organic matter was achieved by using binary water-containing solvents, as well as CO_2. On liquefaction with binary solvents, especially with azeotropes, a synergistic effect of solvents was observed with respect to extract yield. This effect depends upon the temperature of extraction and the nature of kerogen of shale. The synergistic effect may be accounted for a specific behavior of azeotropes under critical and supercritical conditions. The shales whose mineral part contains aluminosilicates, dehydrate alcohols C_2-C_3 into olefins, which further polymerize into branched-chain hydrocarbons. Isopropyl alcohols is more ambient to the reactions of dehydration, dehydrogenation and polymerization, yielding highly-branched aliphatic carbonyl-containing compounds. By liquefaction of the organic matter of kukersite with ammonia obtained from $(NH_4)_2CO_3$ and $(NH_2)_2CO$, as well as in pure NH_3, incorporation of nitrogen into the conversion products has been established. Nitrogen (up to 6-7%) is introduced into both the solid and liquid products. By ammonolysis of oil shales, products with a desired functional group can be obtained. The oils may be used as a raw material for the chemical industry.

30340 (CONF-880589–, pp. 216-222) **Liquid fuel from oil shales by hydrogenation and aqueous conversion.** Nappa, L. (Institute of Chemistry, Tallinn (USSR)); Klesment, I. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Oil shales from Lower Ordovician up to Eocene (organic content 15-60%) from different deposits of the USSR and other countries, were subjected to autoclaving by using hydrogenation and aqueous conversion. On hydrogenation the oil yield increases by a factor of 1.5-2 in comparison with semi-coking, by aqueous conversion different quantities of oil are obtained depending upon the nature of organic matter and mineral part. The study of high-sulfur shales (S content 5-11%), where nitrogen and oxygen content is high as well, showed that by hydrogenation the sulfur content decreases by a factor of about 2-3 in comparison with semi-coking oil. In the processes of thermal destruction under supercritical conditions water rapidly decomposes the organic matter of shales, the process being accelerated by addition of alkali to water. On conversion of some Lower Paleozoic shales substantial amounts of ketones are formed due to the decomposition of phenolic structures, particularly in the case of the Estonian kukersite shale.

30341 (CONF-880589–, pp. 225-232) **Drying mechanism and kinetics model of lump-size Maoming oil shale with high moisture content.** Wang, J. (Beijing United Research Institute of Applied Chemistry and Chemical Engineering (China)); Ding, F.; Li, S.; Qian, J. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The drying process of Maoming oil shale (moisture content 19%, lump size 30-60 mm) has been studied with weight loss and temperature distribution observations of a single lump shale. Three stages of drying process can be shown as: (1) uniform diffusion and surface evaporation of free moisture below 105-110°C, (2) shrinking core evaporation of free moisture at constant temperature of 105-110°C, (3) evaporation of adsorbed water (capillary water) at 110-250°C. Different models for each stage fit well laboratory measurements.

30342 (CONF-880589–, pp. 233-234) **Study on the viability of upgrading Brazilian shale fines through flotation.** Wodtke, R.M.P. (Centro de Pesquisas e Desenvolvimento Leopoldo A. Miguez de Mello (Brazil)); Carrisso, R.C. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The technique of flotation has been employed to study the upgrading of raw shale fines rejected under the pyrolysis process of PETROBRAS-SIX. This study has aimed at the concentration of the organic material contained in this stock, so as to improve the feed quality and consequently making the most of the energy content of this stock. In order to assess, the viability of the shale upgrading through flotation, several lab scale tests have been designed, so as to evaluate the enrichment of the stock through the increase in its heat capacity and the decrease in its ash and sulfur content based on the Headsample, the yields being sufficiently high. The process variables which have been studied encompass, for example: grain-size distribution of the feed by milling, agitation of the pulp, kind and dosage of collector and frother, ways of addition of the frother, pH, solids percentage and period of time of the collector conditioning. The tests have been conducted in a Denver sub-A-Type cell. The results show that, for the variable studied concerned with the flotation process, the mass recoveries have been entirely satisfactory, reaching up to 60% with the gain based on the heat capacity of the original sample being nearly 40%. Besides, it has been observed that the milling up to 635 mesh (ultrafines) is not attractive, at least in the flotation conditions investigated, since, although there be a greater degree of organic material freed, no increase in separation efficiency is observed. Nevertheless, a better comminution of the stock has favored an increase in the shale flotability which is conveyed by an increase in yield.

30343 (CONF-880589–, pp. 245-252) **Isothermal pyrolysis and char combustion of oil shales.** Coburn, T.T. (Lawrence Livermore National Lab., CA (USA)); Taylor, R.W.; Morris, C.J.; Duval, V. Colorado School of Mines, Golden, CO (USA). 1988. DOE Contract W-7405-ENG-48. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Yields and rates of hydrocarbons evolved during pyrolysis of oil shales have been measured with improved accuracy. Green River and New Albany oil shales were heated in a fluidized sand bed, and volatile pyrolysis products were transferred to a combustion tube and burned. Resulting H_2O and CO_2 were detected in real time by mass spectrometry. Residual char was subsequently burned to allow complete C and H balances. Good closure was obtained. Proportions of organic C and H released as pyrolysis products and retained as char were determined. Shale oil loss due to the presence of oxidized shale in the fluidized bed was measured accurately. The authors find that all of the experimental apparatus that the pyrolysis gas contacts must be near pyrolysis temperature avoid condensation of heavy oil which subsequently forms coke and secondary products. They observe a faster release of products with all transfer lines at 450°C than when they are at 300°C. The current uncertainty in pyrolysis rates is due in part to such difficulties with experimental technique.

30344 (CONF-880589–, pp. 263-270) **Investigation on pyrolysis of Huangxian oil shale between 550° 750°C.** Yang, J. (Beijing United Research Institute of Applied Chemistry and Chemical Engineering (China)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

A comprehensive investigation of the second weight loss step for Huangxian (HX) oil shale was carried out by comparison of IR spectra of shale semicoke obtained in various end temperature of pyrolysis and shale sample treated with HCl and in combination with kinetic parameters of the second pyrolysis and other evidences. From these results, it was verified that the second weight loss step is mainly decomposition of dolomite and calcite in the shale. Thermogravimetric data of the second weight loss step were fitted satisfactorily by the first-order kinetic model. Apparent activation energy E and preexponential factor A determined in this study agreed considerably with those of decomposition of dolomite in Colorado oil shale and calcite, which cited from reference.

30345 (CONF-880589–, pp. 287-294) **Isothermal pyrolysis gas chromatography for study of hydrocarbon formation kinetics from kerogens.** Lu, Q. (Beijing United Research Institute of Applied Chemistry and Chemical Engineering (China)); Qin, K.; Wang, T.; Zhu, Y. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Four Chinese immature kerogens of different types from Fushun (FK), Maoming (MK), Huangxian (HSK) oil shales and Huangxian lignite (HLK) were selected as samples in the study of hydrocarbon formation kinetics by using the sequential isothermal pyrolysis gas chromatography technique. The kinetic parameters of light hydrocarbons C_1-C_7, paraffinic monomers and toluene generated from these four kerogens have been determined. The relations between these kinetics parameters and the kerogen structure viewed by FTIR are also discussed. It provides a new standpoint for the study of the pyrolysis mechanism of kerogen.

30346 (CONF-880589–, pp. 295-302) **Study of gas evolution during oil shale pyrolysis by TQMS.** Oh, M.S. (Lawrence Livermore National Lab., CA (USA)); Coburn, T.T.; Crawford, R.W.; Burnham, A.K. Colorado School of Mines, Golden, CO (USA). 1988. DOE Contract W-7405-ENG-48. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Real-time gas evolution during pyrolysis of two Green River Formation (Colorado) oil shales, one eastern US Devonian shale, and two Chinese shales was monitored using a triple quadrupole mass spectrometer (TQMS). The authors calculated kinetic parameters for hydrocarbon generation. For water, carbon oxides, and sulfur gases, they compared evolution profiles and identified the organic/inorganic precursors of each species. They also monitored nitrogen- and sulfur-containing naphtha components. Hydrocarbon gas profiles, except for CH_4, are similar for all shales, and their rates of evolution reach a maximum at around the temperatures of maximum oil evolution. The evolution profiles for H_2, CH_4, H_2O, CO, and CO_2 at high temperatures are affected by the amount of char remaining in shale, carbonate minerals, and the water-gas shift reaction. The water profile, in general, consists of waters from surface dehydration, kerogen pyrolysis, and mineral dehydration. Mineral dehydration was the dominant water source for all shales, but the temperature ranges for the major water peak varied because of widely different mineral composition. Chinese shales evolved much more water than US shales. Major differences between shales were seen in the sulfur gases.

30347 (CONF-880589–, pp. 311-318) **Characterization of flash pyrolysis products from Green River shale.** Shadle, L.J. (Morgantown Energy Technology Center, WV (USA)); Rosencrans, R.D.; Shen, M.; Seshadri, K.S.; Wang, Y.C. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

A Xenon flash lamp was used to pyrolyze oil shale to identify the mechanisms and product distribution during rapid pyrolysis. The net flux to the shale was controlled by changing the intensity and pulse width of the input radiant energy or by altering the gas atmosphere

from vacuum to helium. The liquid composition underwent dramatic changes with increasing the net flux to the sample: the molecular weight decreased, and the extent of aromatic ring condensation increased. Compared to oils from slow heating processes, the products were high in molecular weight, had a larger number of polar species, and had a higher concentration of condensed aromatic structures. The rapid pyrolysis products exhibited a broader range of molecular weights. The results suggest that relatively large fragments of the kerogen were evolved and undergo hydrogen redistribution. Heteroatomic structures such as ethers, carbonyl groups, and hydroxyl groups were either retained from the original kerogen or formed during pyrolysis possibly from the cleavage of linkages.

30348 (CONF-880589–, pp. 335-342) **Kinetics of the cracking and coking of oil shale vapors and their relevance to the processing of Australian oil shales.** Wall, G.C. (CSIRO, Menai, New South Wales (Australia)); Udaja, P. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Data are presented on the kinetics of cracking of shale oil vapors prepared from samples of Australian oil shales from the Condor, Stuart and Nagoorin deposits in Queensland. The kinetics of thermal cracking were studied over the temperature range 500 to 600°C at vapor residence times of 4 to 20 seconds. All the oils showed similar trends in cracking behavior. Although thermal cracking was minimal at 500°C and 10 s residence time, it became increasingly significant at higher temperatures and residence times. Coke formation was small compared to gas production, with the heavy gas oil being the most severely depleted fraction. Naphtha, kerosene and diesel fractions increased during thermal cracking. The kinetics of coking of shale oil vapors on shale ash were measured for oil shale samples from the Condor, Duaringa, Lowmead, Nagoorin, Nagoorin South, Rundle, Stuart and Yaamba deposits. The results are correlated in an equation which gives the yields of carbon deposited on the shale ash as a function of reaction time and oil vapor concentration. Reaction coefficients which characterize the reactivities of the oils and ashes are given. Additional data which relate the yields of carbon to the other reaction products are also presented. On the basis of these data, recommendations are made for the selection of retort operating conditions to minimize oil yield losses due to coking.

30349 (CONF-880589–, pp. 353-359) **Reactor-combustor fluidized bed retorting of Maoming oil shale.** Luo, R. (Maoming Petroleum Industrial Corp. (China)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Fluidized bed retorting of shale fines of average size 0.2 mm in a reactor-combustor testing equipment of 24 t/day capacity was carried out with shale ash as heat carrier. For each ton of oil shale 51-60 kg of shale oil was produced, with oil yield 68-78% against Fischer assay. Less than 0.3% mechanical impurities was present. Gasoline and diesel fuel accounted for 65-71% of whole shale oil. Gas yield 53-58 m^3/ton, with calorific value 4000-4100 kcal/m^3 (16,750-17,150 kJ/m^3). More than 60 runs were made, the longest one being 15-20 days.

30350 (CONF-880589–, pp. 360) **Development of an oil shale fines pyrolysis technology.** Lisboa, A.C.L. (Superintendencia da Industrializacao do Xisto, Parana (Brazil)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

PETROBRAS is developing a spouted bed technology for oil shale fines pyrolysis. The spouted bed is a form of solid-gas contact which promotes a circular movement of particles inside the bed. It is made up of two distinct regions: a central one, where particles are dragged by a gas jet, forming the spout itself, and a ring-shaped region that surrounds the first, where particles move down in countercurrent with the gas. PETROBRAS' work continues the basic studies initiated by CENPES (PETROBRAS' and R and D Center) which researched the spouted bed for gasification and oil shale pyrolysis on bench units. In terms of pyrolysis, the reactor has operated both autothermically, burning part of the organic matter in the reactor, and with inert atmosphere, a condition in which all the pyrolysis heat used to be supplied by the reactor wall. In 1986, a basic project was designed for an industrial plant of fines pyrolysis in a spouted bed accompanied by a techno-economic assessment. The good perspectives at this research stage have been led to the erection of a pilot plant. The fines pyrolysis pilot plant in a spouted bed has a 30cm diameter, 2m high stainless steel reactor with capacity to operate with three gas intake nozzles and two bed heights with a flow of 150kg/hr. This plant aims at confirming the good results verified on the bench unit, and obtain new information about the process. A partially transparent vessel of the same size as the pilot reactor is operating for cold assays. This vessel is being used to observe and quantify the performance of the spouted bed under pilot plant conditions - except for temperature - in addition to personnel training.

30351 (CONF-880589–, pp. 361-368) **Oil shale retorting in dense phase hot-solid recycle systems.** Cena, R.J. (Lawrence Livermore National Lab., CA (USA)); Taylor, R.W. Colorado School of Mines, Golden, CO (USA). 1988. DOE Contract W-7405-ENG-48. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Oil shale processing remains primitive despite more that a century of study and development. To expand the industry in China, and to develop an industry in the USA, more efficient, environmentally acceptable oil shale retorting schemes are required. Rapid pyrolysis, solid-recycle retorts offer high throughput and improved oil yield compared to hot gas retorts currently in operation. At the Lawrence Livermore National Laboratory (LLNL), the authors are studying this class of retort, by combining laboratory and mathematical model development efforts with operation of a 1 ton/day pilot-scale, solid-recycle retorting system. In this paper they first discuss hot gas and hot solid retorting methods. They then compare laboratory pyrolysis kinetic and yield results with those obtained using the LLNL pilot retort, processing both Western and Eastern USA shales. Sulfur chemistry important in solid-recycle retorting is discussed. Based on this experience, coupled with laboratory measurement for shales from Maoming and Fushun, China, they discuss the possibility of processing Chinese shales in rapid-pyrolysis, solid-recycle retorting systems.

30352 (CONF-880589–, pp. 369-375) **Retorting of four kinds of small size oil shale with an inclining type retort.** Enomoto, M. (National Research Institute for Pollution and Resources, Ibaragi (Japan)); Takahashi, S.; Sato, S. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

In preparing shale feed stock for a vertical retort, the most popular type of above-ground retort, powder shale of below about 5 mm in diameter should generally be removed to obtain smooth shale flow. However, the removed powder shale has to be retorted also to make full utilization of oil shale resources. Aiming at using a multi-tube heat exchanger as a retort, the authors carried out a preliminary study on a single tube retort set at 45 degrees to test its efficiency and practicability using oil shales from Colorado, Mae sot (Thailand), Condor (Australia) and Maoming (China). The retort could treat oil shales consisting of smaller particle size than 5 mm in diameter giving 90% of oil yield at the most, through in some cases plugging-up occurred depending on kind of shale and operating conditions. Burning of carbon deposit on retorted shale with a combustion unit equipped at the bottom of the retorting section was also tested and it could work depending on particle size distribution of feed shale.

30353 (CONF-880589–, pp. 376-383) **Design of a new oil shale retort for China's fushun region.** Nuttall, H.E. (Univ. of New Mexico, Albuquerque (USA)); Du, C. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International*

conference on oil shale and shale oil; Proceedings. Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Though oil shale retorting has been a well known process for over 100 years, there is still a need for improved designs. Recent attempts in the USA to process shale commercially using new technologies has either failed or the processes were not commercially economical at this time. After reviewing the disadvantages and advantages of current retort technology, a new retorting system is presented that takes advantage of fluidized bed combustion technology and removes most of the disadvantages of previous retorts. Within the coal fired fluidized bed combustor (FBC), the oil shale is processed in an array of auger-type vertical transport reactors. In reviewing oil shale deposits throughout the world, it was noted that most oil shales are of relatively low grade and that their residual carbon content is insufficient to provide all of the retorting heat; hence, either some of the product oil and gas are burned or an additional energy source is required. Since coal is often found with or nearby oil shale deposits, it was chosen as the primary heat source for the new retorting design. The paper contains the preliminary retort design, results from the system analysis, and a summary comparison of the calculated retort performance as compared to China's Fushun retort.

30354 (CONF-880589–, pp. 384-391) **Maoming and Huadian oil shale retorting using solid heat carrier.** Guo, S. (Dalian Institute of Technology (China)); Luo, C.; Han, Z.; You, L.; Han, W. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

A continuous experimental unit of retorting with capacity 10 kg/h using hot spent shale as solid heat carrier was set up. The retorting of Maoming and Huadian oil shale was investigated in the unit. The size range of oil shale sample was 0-5mm. Hot spent shale as heat carrier at temperature of 700-750°C was mixed with raw oil shale which was preheated to about 120°C, and the ratio of spent shale to raw oil shale was 3-4. The retorting temperature range was 445-525°C, the optimal temperature was approximately 500°C for oil yield, it was about 90% of Fischer Assay.

30355 (CONF-880589–, pp. 400-407) **Development of oil shale retorting plant in Japan. Part II. Operation of the pilot plant.** Yabushita, T. (Japan Oil Shale Engineering Co., Ltd., Tokyo); Yuta, K.; Oki, T. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

On consignment from the Ministry of International Trade and Industry (MITI) and the Japan National Oil Corporation (JNOC), Japan Oil Shale Engineering Co., Ltd. (JOSECO) commenced the operation of an oil shale pilot plant in May 1987. Though JOSECO is still continuing the experimental operation as of the end of January 1988, all the data the authors have obtained to date have been satisfactory.

30356 (CONF-880589–, pp. 408) **Large capacity aggregates for retorting lump oil shale.** Yefimov, V.M. (Ministry of Petroleum Refining and Petrochemical Industries of USSR, Moscow); Riik; Rooks; Nazinin. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

In USSR, traditional design of gas generator for the production of shale oil has been modernized. The first such generator had the capacity of 30 tons oil shale per day. The capacity of gas generator modified with cross flow of hot gas medium (so called Kiviter process) increases to 200 tons per day. New gas generator has been constructed in 1981 and put into operation with the daily capacity of 1000 tons oil shale. For developing gas generator with the daily capacity of 1500 tons oil shale, the pyrolysis chamber has been well designed. By using Kiviter process, it is possible to develop retorting aggregates for processing of oil shale with low organic contents with the capacity up to 10,000 tons oil shale per day.

30357 (CONF-880589–, pp. 409-414) **Technical features of Fushun-type retort today.** Wang, X. (Fushun Petrochemical Corp. (China)); Huang, G. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Fushun-type retort today has evolved in about 40 years of development after the founding of PRC. Its technical features are long on-stream period, short start-up time, adaptability to a variety of raw shale, little mechanical impurities in the product-shale oil, self-sufficient in heat supply in retorting low-grade oil shale (limiting Fischer assay 6%). The paper describes the principle of operation and the technical features of this type of retort, and then discusses the outlook for an improved version.

30358 (CONF-880589–, pp. 424-431) **Advances in fragmentation for in situ bed production.** Britton, K. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Intensive research in the late 1970s on fragmentation for in situ processing was followed by lower levels of activity as funding diminished. Much of this work has been published piecemeal with significance obscured by lack of context. This paper is presented from the viewpoint of the blast design engineer to provide the context. It reviews the status of the commercial scale projects and work related to the cratering theme which dominated US government investment; then discusses developments regarding dilatancy, fragmentation theory, explosives and other areas relevant to future in situ efforts. It is shown that, though some new questions have been raised, the major problems of the past now appear under control and a variety of developments leave the engineer far better positioned than he was a decade ago.

30359 (CONF-880589–, pp. 432-439) **Significance of dilatancy to in situ bed preparation.** Britton, K. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

It is noted that longstanding problems exist in the fragmentation field. Dilatancy is briefly described and evidence presented from in situ blasts and computer modeling to establish it as the common factor to their old difficulties. It is shown to be important both to the early phenomena of the fragmentation process and to the later behavior of the moving rubble. Implications for blast design are discussed, with examples, and it is shown that success with uniform fragmentation is unlikely. Implications for computer modeling are discussed.

30360 (CONF-880589–, pp. 440-448) **Modified-in-situ technology combined with aboveground retorting and circulating fluid bed combustors could offer a viable method to unlock oil shale reserves in the near future.** Hulsebos, J. (Occidental Oil and Gas Corp., Tulsa, OK (USA)); Pohani, B.P.; Moore, R.E.; Zahradnik, R.L. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

This paper describes the technology and economics of producing syncrude from oil shale using Occidental's Modified-In-Situ (MIS) process combined with Aboveground Retorting (AGR). Electricity is produced from shale fines, retort offgases and spent shale using Circulating Fluid Bed Combustors (CFBC). This combination of technologies increases extraction of heat and chemical values from the shale, thereby improving the economics of shale oil. Most of the technologies utilized in this process arrangement have been proven on a commercial scale. MIS retorts have been demonstrated since 1972, with five retorts of commercial size. A full-scale AGR has been in operation at Parachute Creek in Colorado for the last four years. Its remaining problems appear to be solely mechanical in nature and should be resolved before another commercial-size unit is built. CFBC technology is also well proven, although the effects on

combustion stability and sulfur capture of shale fines and spent shale in combination with MIS retort offgas need to be demonstrated. Economic analyses indicate that a 20% internal rate of return on a commercial plant at the C-b site in Rio Blanco County, Colorado, would require a syncrude price in 1987 dollars between $23 and $35 per barrel (0.159 m^3), depending on the plant capacity and real oil price growth.

30361 (CONF-880589–, pp. 451-460) **Preliminary study on hydrotreating of a high sulfur content shale oil.** Zhu, Z. (Beijing United Research Institute of Applied Chemistry and Chemical Engineering (China)); Qin, K.; Wang, T.; Zhu, Y.; Zhang, Y. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Hydrotreating of whole fraction of a high sulfur content shale oil (S 8.52%, N 0.87%) was carried out on a RN-1 catalyst in a fixed-bed reactor (100 ml) to clarify the relationship between operating conditions and the properties of product oils. The reaction conditions used are: hydrogen pressure 64 atm; reaction temperature range 300-400°C; LHSV 0.5 and 1.0 hr^{-1}; hydrogen and feedstock ratio 800 vol/vol. Most of the physical and chemical properties of the hydrotreated oils are improved. GC-MS analysis confirms that the sulfur-containing compounds in the shale oil are mainly in aromatic structures, such as thiophenic, benzothiophenic and dibenzothiophenic derivatives. The sulfur removal during the hydrotreating is easier than that of nitrogen. As the reaction temperature increased from 300° to 400°C, percentage of sulfur removal increased from 57.75 to 98.12, while nitrogen removal increased from 25.29 to 82.76. At the optimum condition of the study (H_2 pressure 64 atm, temperature 380°C, LHSV 0.5 hr^{-1} and H_2/feedstock 800 vol/vol), sulfur and nitrogen contents of the product oil was reduced to 670 and 1100 ppm respectively, it may be suitable as a syncrude for the petroleum refinery.

30362 (CONF-880589–, pp. 461-469) **Unocal Corporation's commercial experience in upgrading shale oil to produce a high quality syncrude.** Reeg, C.P. (Unocal Corp., Brea, CA (USA)); Duir, J.H.; Randle, A.C. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Unocal Corporation operates a commercial oil shale facility in the US. The facility is designed to produce 66 m^3/h of premium syncrude. Syncrude produced from this facility is processed in Unocal's conventional petroleum refineries. Syncrude is a higher quality refinery feedstock than the best Middle East crudes. Jet and diesel fuels distilled from syncrude are superior. Performance of Unocal's commercial Upgrading Plant that converts raw shale oil to syncrude has been excellent. Properties of raw shale oil, syncrude, jet fuel and diesel fuel are presented.

30363 (CONF-880589–, pp. 470-477) **Upgrading Julia Creek shale oil - syncrude or fully refined products.** Stephenson, L.C. (CSR Ltd., Sydney (Australia)); Muradian, A.; Fookes, C.J.R.; Atkins, A.R.; Walters, C.K. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Two upgrading strategies for refining Julia Creek shale oil have been evaluated, i.e., production of a syncrude, versus fully refined transport fuels. Results indicated that both options were viable for this Australian shale oil, and influencing factors are more likely to be market related than technical. During this study, suitable conditions were identified for the production of specification quality gasoline, jet and diesel fuels.

30364 (CONF-880589–, pp. 478-485) **Upgrading of shale oil by an ebullated-bed reactor.** Hayashi, M. (Mitsubishi Oil Co., Ltd., Hiroshima (Japan)); Kohno, F.; Masuda, T.; Shinoda, N.; Shimada, T.; Kaneko, M.; Fujita, H.; Ohmoto, S. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Proposed is a refining system composed of ebullated-bed type hydrorefining (1st stage treating) and processing of a mixture of syncrude and petroleum by use of conventional petroleum refining technologies (2nd and 3rd-stage treating) which upgrades the quality of shale oil containing large quantities of olefins and nitrogen compounds, to the level of current petroleum products. To conduct an evaluation of this system, an ebullated-bed type bench plant processing 1.5 Bbl/day of shale oil was used to perform a hydrorefining test and a fixed bed type bench plant was used to perform 2nd and 3rd-stage treating tests. After the evaluation of the operating conditions and the products, the feasibility of this system was confirmed.

30365 (CONF-880589–, pp. 486-492) **New scheme for upgrading Fushun shale oil.** Qian, H.; Tian, H. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Commercial practice of upgrading Fushun shale oil in 50 years was received. In view of the situation that shale oil is now being used directly as boiler fuel, a new scheme for upgrading is proposed. Shale oil is first treated by exhaustive delayed coking to light fractions which were treated successively with dilute alkali, and sulfuric acid to recover the acidic and basic nonhydrocarbon components as fine chemicals and the remaining hydrocarbons, containing about 0.4% N can thus be readily hydrotreated to obtain naphtha, jet fuel and light diesel fuel. This scheme is profitable and can be conveniently coupled into an existing petroleum refinery.

30366 (CONF-880589–, pp. 621-631) **Swedish shale gasification research program.** Andersson, L.A. (Lund Institute of Technology (Sweden)); Bjerle, I. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

This paper gives a background to, and a summary of the shale gasification program in Sweden. At the Department of Chemical Engineering II at the Lund Institute of Technology laboratory experiments in bench scale equipment were performed. Most of these experiments were made in a conventional fluidized bed reactor and a fluidized twin bed reactor developed at the department. In the twin bed reactor the heat generated in a circulating combustion bed is transferred to the bubbling gasification bed by the char. The research program in Ranstad concentrated on experiments on a pilot plant scale. Both a scaled-up version of the conventional fluidized bed reactor in Lund with a capacity of 250 kg shale/h, and a high temperature slagging gasifier with a capacity of 10 tons/h were built and operated.

30367 (CONF-880589–, pp. 635-642) **Oil shale industrialization in Brazil.** Batista, A.R.D. (Petroleo Brasileiro S.A., Rio de Janeiro (Brazil)); Terabe, K. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Brazil has abundant oil shale resources, about 120 billion t.o.e. (tons of oil equivalent) of oil according to estimates made by US Geological Survey. The most important deposit of oil shale is the Irati Formation, of Permian origin, that forms a part of the Paleozoic sediments of the Parana basin. It is located in the South of Brazil. Brazil is a country that invested continuously more than 500 million dollars on shale technology those last 34 years, mainly in the development of the PETROSIX Process. A semi-commercial plant using the PETROSIX Process has produced more than 370 thousand t.o.e. of shale oil, 35 thousand tons of sulfur and operated continuously more than 95 thousand hours, achieving today an operating factor of 94%. A commercial plant, having a 11 m diameter PETROSIX Retort is being erected to produce 550 tons of shale oil, 43 metric tons of LPG, 70 metric tons of fuel gas and 65 metric tons of sulfur by processing 7800 t/d of oil shale. Besides the PETROSIX Process, used to retort coarse particles of oil shale, PETROBRAS

are developing other kinds of processes to retort oil shale fines, using entrained bed and spouted bed concepts, and to burn the spent shale using circulating fluidized bed concepts.

30368 (CONF-880589–, pp. 658-662) **Sixty years of oil shale retorting industry in Fushun.** Yang, J. (Fushun Petrochemical Corp. (China)); Liu, G. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Oil shale retorting industry in Fushun dated back to 1928 and has been operating for 60 years: 1928-1949, build-up of retorting industry; 1949-1960, development of retorting technology; 1960 to present, comprehensive utilization of oil shale. The annual shale oil production reached a maximum of 257,000 tons in 1942, a hallmark of industrial operation. Since the founding of PRC in 1949, retorting technology had been developed considerably and the annual production topped 780,000 tons in 1959. In the fifties shale oil accounted 30-50% of the total oil production and played an important role in economy and defense in China. Since the drastic increase of crude oil production in the sixties, comprehensive utilization of oil shale has got due attention and upgrading of technology has been pursued to develop this alternate energy. Six decades of operation in Fushun can be ascribed to rich resources, matured technology, economical justifiability and great demand. In these sixty years, large amounts of shale oil, gasoline, kerosene, diesel oil, lubricants, paraffin, oil coke, ammonium sulfate, etc. have been produced. A much brighter prospect is ahead for the oil shale retorting industry in Fushun.

30369 (DOE/MC/11076–2687) **The numerical simulation of forward combustion in a tube reactor using the Sunnyside resource.** Vaughn, P. Western Research Inst., Laramie, WY (USA). Feb 1988. 42p. Sponsored by DOE Fossil Energy. DOE Contract FC21-86MC11076. Order Number DE89000959/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Tar Sand Reservoir Simulator (TSRS) is enhanced and used to model the forward combustion of Sunnyside tar sand in Western Research Institute's (WRI) tube reactor. The enhancements to the model account for boundary heat transfer, gravity drainage, and porosity variation with coke deposition. The model is successfully used to simulate the forward combustion of Sunnyside tar sand in a tube reactor. The results from one simulation of one test using air as an injectant are compared to the test results. A number of simulations, consisting of a predictive simulation followed by a number of simulations designed to match the experimental performance, were performed on the experiment. Compared to the observed performance, the predictive simulation overestimates oil yield and frontal velocity by two-thirds and generates combustion peak temperatures 150°F (66°C) in excess of those observed. The predictive simulation does predict a large pressure drop early in the test, but unlike experimental behavior, this large pressure drop dissipates very rapidly as the bitumen becomes readily mobilized at the higher tube temperature during the remainder of the test. 16 refs., 4 figs., 4 tabs.

30370 (DOE/MC/11076–2690) **Eastern oil shale conversion using the ROPE [Recycle Oil Pyrolysis and Extraction] process.** Cha, C.Y.; Fahy, L.J.; Guffey, F.D. Western Research Inst., Laramie, WY (USA). Sep 1988. 25p. Sponsored by DOE Fossil Energy. DOE Contract FC21-86MC11076. Order Number DE89000962/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Western Research Institute has developed the Recycle Oil Pyrolysis and Extraction (ROPE©) process. Preliminary testing of this process has been conducted with oil shale and tar sand. Preliminary tests were conducted with the objective of obtaining a product that contained a high percentage of aromatic compounds which would be desirable as a feedstock for benzene-toluene-xylene (BTX) or for high-density fuels. The main objectives of this research were to conduct a 10-day shakedown tests of the 6-inch bench-scale unit (BSU) using eastern oil shale and to conduct a series of similar experiments in the 2-inch process development unit (PDU) to confirm oil yield and quality at steady-state conditions. One 10-day shakedown tests was conducted in the BSU. Shale oil produced by the Dravo process was used as the starting heavy recycle oil. Difficulties occurred, however, in maintaining heavy recycle oil, and product oil had to be injected into the pyrolysis zone to compensate for the losses. Oil shale fines also plugged the heavy-oil recycle pump. Three eastern oil shale tests were conducted in the PDU. Heavy-oil pumping problems and reactor plugging occurred during the first two tests. The third test, however, was conducted for 50 hours with no mechanical problems. 2 refs., 10 figs., 15 tabs.

0405 Properties and Composition

Refer also to citation(s) 30329, 30333, 30337, 30345, 30346, 30347, 30361, 30396, 30405, 30409, 30420

30371 (ACERR–1989) **Alberta Research Council [research reports].** Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada). [1989]. vp. (CE–02653). Available from Alberta Energy and Natural Resources, Information Centre, 9920-108 St., Edmonton, AB, Canada T5K 2M4; $N/C.

A series of research reports was authorized by the Alberta Research Council and published in this volume. The reports present the results of research in the fields of separation processes, such as chromatography, for the analysis of components of bitumens; processing of coal with heavy oils; structural chemistry of coals; characterization and liquefaction of coal; and modelling of liquefaction processes. Separate abstracts have been prepared for seven reports from this volume.

30372 (ARC–1989) **Alberta Research Council [research reports].** Alberta Research Council, Edmonton, AB (Canada). [1989]. 112p. (CE–02438). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Most of the papers in this report deal with the liquefaction and solubilization of coal. Coprocessing, solvent liquefaction, pyrolysis and hydropyrolysis are investigated. The chemical structure of coal (reactivity of nitrogen and hydrogen, molecular weights) and its pore structure are investigated in relation to liquefaction and solubilization. Attention is paid especially to bituminous and subbituminuous coals. Two papers deal with alumina, supported and iron oxides catlysts for the Fischer-Tropsch synthesis. All twelve papers have been abstracted.

30373 (CONF-880589–, pp. 85-91) **Variations in the composition of steranes and triterpanes in oil shales of different origins and steges of maturity.** Bondar, E. (Institute of Chemistry, Tallinn (USSR)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Sterane and triterpane stereochemistry as quantitatively analyzed by computerized capillary gas chromatography - mass spectrometry is mainly used for oil-oil and oil-source rock correlation. These saturated tetra- and pentacyclic hydrocarbons are rather easily detectable because of their specific mass spectrometric fragmentation patterns. The following examples demonstrate the applicability of sterane and triterpane stereochemistry to comparative organic geochemical investigation of oil shales of different origins and stage of maturity.

30374 (CONF-880589–, pp. 92-100) **Petroporphyrins in several oil shales, China.** Liao, Z. (Research Institute of Petroleum Exploration and Development, Beijing (China)); Huang, D.; Shi, J. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

A study of petroporphyrins from several oil shales was carried out by using TLC, UV, HPLC and MS. This paper deals with the type and structure of porphyrins, the distribution of carbon numbers and DPEP/ETIO values, etc. The results indicate that the porphyrins exist in common oil shales except for the poor oil shale from Shengli Oil Field which was buried under 3000m deep. During the early diagenetic stage, the reaction from DPEP to ETIO is very strong and

then slows down with diagenesis. The ratio of DPEP/ETIO was related not only to maturation but also to the Ox-Re condition of the environment. The low DPEP/ETIO value of Maoming oil shale is due to the weaker oxidation environment.

30375 (CONF-880589–, pp. 101-109) **Investigation of the structure of kerogens based on the oxidation products from multistep alkaline permanganate degradation.** Yang, Q. (Beijing United Research Institute of Applied Chemistry and Chemical engineering (China)); Xie, R.; Cao, Z.; Li, X.; Zhang, G.; Fan, W. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The stepwise alkaline $KMnO_4$ oxidation of Huangxian and Maoming oil shale kerogen concentrates was carried out. The oxidation products were separated with solvents and analyzed by IR, GC and GC/MS. The paper discusses the distributions of C, N, and S in the fractions and their effects on oxidation, the chemical structure of kerogen, and the GC and GC/MS analyses of the solvent soluble acids of the oxidation products.

30376 (CONF-880589–, pp. 110-111) **Structural characterization of the kerogen from Pumpherston oil shale.** Vitorovic, D. (Univ. of Belgrade (Yugoslavia)); Ambles, A.; Bajc, S.; Cvetkovic, O.; Milojkovic, D. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

In order to contribute to structural characterization of the kerogen from Pumpherston (Scotland) oil shale, a twenty-nine step alkaline permanganate degradation of this kerogen was carried out. According to atomic H/C and O/C ratios, 1.64 and 0.10, respectively, this kerogen was classified as type I kerogen. The Pumpherston shale kerogen was of somewhat higher maturity, its vitrinite reflectance being 0.59%. A moderate total yield of oxidation products was obtained, 65.14% based on original kerogen, the yields of neutrals and bases, ether-soluble acids, acids from aqueous solutions and precipitated acids being 3.73%, 35.94%, 3.33% and 22.14%, respectively. The dominance of saturated aliphatic acids in the oxidation products suggested a prevailing aliphatic cross-linked structure of Pumpherston oil shale kerogen. A relatively low participation of aromatic acids in the oxidation products was observed in spite of somewhat higher maturity of this kerogen, compared to other examined type I kerogens. The small proportion of alkanepolycarboxylic acids suggested a smaller participation of alicyclic and/or heterocyclic precursor structures. The degradation of the kerogen from Pumpherston oil shale, shown as example, will serve as basis for demonstration of the feasibilities of an optimized alkaline permanganate oxidation method for structural characterization and classification of kerogens.

30377 (CONF-880589–, pp. 120-126) **Thermal properties of Chinese oil shale - measurement of thermal conductivity of oil shale.** Lu, S. (Beijing United Research Institute of Applied Chemistry and Chemical Engineering (China)); Wang, T.; Guan, M.; Huang, Y. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The thermal conductivity is one of the important thermal character of oil shale. Many previous authors have used a transient line-probe method to measure the thermal conductivity of oil shale that is handicapped by several difficulties. This paper reports on the development of a steady-state guarded hot plate method for the measurement of thermal conductivity of oil shale. A NK-III-50S type thermal conductivity meter was built up by the authors. Measurements were carried out in the temperature range 50-300°C on fused quartz and oil shale. In order to eliminate the effect of the thermal contact resistance of the apparatus with the oil shale sample surfaces on the measurement, the overall thermal resistance of three different thickness Fushun oil shales were measured. Predictive equations showing the variation of the overall thermal resistance with thickness are presented. The results of the present investigation show that it is very good straight line. According to the slope of the straight line obtained in the present study, the thermal conductivity of Fushun oil shale was determined. Their thermal conductivities were 0.9849-1.0005 W/mk. The relative equation showing the variation of thermal conductivity with temperature for Fushun oil shale is presented.

30378 (CONF-880589–, pp. 127-135) **High resolution transmission electron microscopy (TEM) in the study of oil shales.** Glikson, M. (Australian National Univ., Canberra). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

In the broadest terms, the TEM work reported here has greatly extended knowledge and understanding of the nature and origin of the organic matter in oil shales. The study has shown the limitations which exist when light microscopy alone is used to assess the nature and properties of organic matter. Much important information is available only at the resolutions possible with transmission electron microscopy. The nature and, in many cases, the source of the vitrinite-like (bituminite) organic matter have been established through TEM and carbon-isotope analysis, and it is shown to consist of bacteria and their degradation products. The microbial remains may occasionally be recognized in TEM observations, which also allows them to be clearly distinguished from algal remains. The lack of fluorescing properties of the vitrinite-like organic matter can be understood, since the alteration of lipids due to biological decomposition is very extensive. Vitrinite-like organic matter of oil shales, although generally of lower reflectance than vitrinite, displays a range of reflectances depending on sources and diagenetic history. The source of some trace elements presents in high concentrations in the Rundle-Condor and other oil shales have been established by TEM/microprobe and carbon-isotope analysis, and it is shown that these have been leached and mobilized from the hinterland by humic acids, and transported into the depositional basin. Humic acids are clearly distinguishable from other organic components in TEM.

30379 (CONF-880589–, pp. 136) **Neutron activation analysis possibilities for the elemental composition research in oil-shales, oil-bituminous rocks, petroleum and their fractions.** Solodukhin, V.P.; Kabirova, G.M.; Smetannikov, V.V. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Activation analysis principal bases are reported briefly in the paper. According to the publications of the Soviet and foreign authors a review of activation analysis techniques to determine the elemental composition of the organic fossils is presented. Their possible application is considered. Technique developments performed at the Institute of Nuclear Physics of the Academy of Sciences of the Kazakh SSR on WWR-K atomic reactor are reported in detail. They include activation by both thermal and epithermal neutron fluxes with gamma-ray spectra measuring of short-lived, intermediate and long-lived radionuclides with both coaxial and low-energy photon detectors connected to a 4096-channel analyzer. The techniques make it possible to determine concentrations of 8 to 15 elements from the following list: Na, Al, S, Cl, Ca, V, Mn, Co, Cu, As, Br, Sr, Mo, In, Sb, I, Ba, U in petroleum and organic fossil fractions. In analyzing oil-shales and oil-bituminous rocks the quantity of the identified elements is in the interval from 10 to 30, the list of the elements mentioned above being added by the following ones: Mg, K, Sc, Ti, Cr, Fe, Ni, Zn, Ga, Se, Rb, Ag, Cs, La, Ce, Nd, Sm, Eu, Tb, Dy, Ho, Yb, Lu, Hf, Ta, W, Re, Au, Th. Development perspectives of the technique research for the elemental analysis of the organic fossils are being considered.

30380 (CONF-880589–, pp. 137-144) **Comparison between Chinese and Colorado oil shales.** Laity, D.S. (Chevron Research Co., Richmond, CA (USA)); Lok, B.K.; Hsieh, C.R. Colorado School of Mines, Golden, CO (USA). 1988. From International conference

on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Three oil shale samples from the People's Republic of China were analyzed and compared with a typical Colorado oil shale sample. Two of the samples were taken from the Fushun area in Manchuria, and the third one was from the Maoming area in Southern China. Although the total organic carbon contents are higher, the Chinese shales yielded less oil and significantly more chars than a typical Colorado shale. Also, unlike Colorado shale, the Chinese shales have very low levels of carbonate carbon and all carbonates appeared to decompose during retorting. These unique characteristics will allow a relatively lean Chinese shale to be processed in a heat-balanced char burning retort, such as Chevron's Staged Turbulent Bed (STB) process, with minimum external energy. The Chinese shale oils had higher API gravity and lower nitrogen. Their refining values are therefore probably higher.

30381 (CONF-880589–, pp. 145-154) **Factors affecting the results of Fischer assay of oil shale.** Chen, J.; Liu, C. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

A comprehensive comparison was made between four Fischer Assay procedures of oil shale, currently used in different countries. Based on the summary of comparison, a modified aluminum retort was recommended, and factors, especially the heating conditions, affecting the result of assay were examined in detail. As a result, a new modified Fischer Assay procedure was established, which has been approved by China Petrochemical Corporation as the new trade standard.

30382 (CONF-880589–, pp. 167-175) **Study of oxidation technique of oil shale.** Cao, Z. (Beijing United Research Institute of Applied Chemistry (China)); Zhao, Q.; Yang, Q.; Li, S.; Zhang, G.; Nan, G. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Owing to high chemical activity, Huangxian (Shandong province) oil shale and Maoming (Guangdong province) oil shale can be directly oxidized by air for producing organic acids, without being treated and concentrated. The effective conversion ratio of organic carbon could reach more than 50% with operation pressure 8 kg/cm^2 and temperature 155°C. The kinetics and mechanism of oxidation reaction of Huangxian oil shale were investigated. The activation energy of oxidation of cross-link bonds in the kerogen was 43 KJ/mole within 115-155°C. The mechanism was also confirmed by IR of residues. The IR of products indicated that water-insoluble acids of Huangxian black oil shale were mainly aromatics, while for Maoming oil shale mainly aliphatics. The composition of Huangxian water-insoluble acid was further verified by NMR.

30383 (CONF-880589–, pp. 191-192) **Hydroretorting, rock-eval, and Fischer assay analyses of some world oil shales.** Dyni, J.R. (Geological Survey, Denver, CO (USA)); Anders, D.E.; Rex, R.C. Jr. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Oil shales of varied origin and age were found to respond widely to hydroretorting assay (HA). For oil shales containing $\geq$ 40 liters of shale oil per metric ton by HA, the yields by HA ranged from 110 to 461% of yields obtained by Fischer assay (FA). To gain a better understanding of how different oil shales respond to HA analysis, 92 samples of oil shales of lacustrine, terrestrial, and marine origin ranging in age from Cambrian to Tertiary were collected from more than 30 deposits around the world. The samples included 52 marinites, 22 lamosites, 3 tasmanites, 1 kukersite, and 14 samples of undetermined type. In addition to HA and FA analyses, the samples were also analyzed by Rock-Eval and the qualitative mineralogy of the samples was determined by X-ray diffraction. The resulting data indicate that the type of kerogen, as well as the degree of geothermal maturation of the deposit, are significant factors in the oil yields that were obtained. The marinites (35 samples) gave the best HA results, ranging from 141 to 461% of FA and averaging 252%. Some of the best samples of this group include those from the Devonian oil shales of the eastern US and Canada; the Cretaceous oil shales of Morocco, Jordan, and Israel; and the Cambrian Alum Shale of Sweden. The Alum Shale is particularly noteworthy; HA results for two samples were 302 and 461% of FA. However, oil yields by HA and FA decrease to nil for samples of Alum Shale from Norway where the deposits were strongly altered by thermal metamorphism. The HA results for the lamosites and tasmanites were lower, ranging from 86 to 192% of FA and averaging 135% of FA. No significant correlation was found between the HA/FA ratios and the mineralogy of the samples.

30384 (CONF-880589–, pp. 201-207) **Comparison of extracts and yields from the thermal solution of a typical Green River oil shale and a Sunbury oil shale.** Tyler, A.L. (Univ. of Utah, Salt Lake City (USA)); Leavitt, D.R.; Kafesjian, A.S. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The fraction of the organic material in oil shale that can be removed by thermal solution is significantly higher than that recovered by pyrolysis - e.g. by Fischer assay. For the Green River oil shale, yields of 90% to 95% of the total organic material (~125% of Fischer assay) can be recovered with either cyclohexane or tetraline at 380°C. The maximum yield of 80% of the total organic (~250% of Fischer assay) was obtained for the Sunbury oil shale with tetralin. Solid State ^{13}C NMR analyses and CHN elemental analyses of the residues confirms that tetralin, a hydrogen donor, is effective in removing aromatic structures in the kerogen which form chars upon pyrolysis. The aromatic carbon in the Green River oil shale is removed by tetralin equally as well as the aliphatic structures, but in the Sunbury oil shale, some polycyclic and heterocyclic structures remain intractable to tetralin. The H/C atomic ratio in the solid residue remains constant for material extracted with tetralin, but falls dramatically with yield for non hydrogen-donor solvents such as toluene, cyclohexane, and methylcyclohexane. The boiling-point distribution of the tetralin extracts are very nearly the same for each of the oil shales studied. The boiling point has a very narrow range with approximately 80% boiling between 380°C and 400°C.

30385 (CONF-880589–, pp. 253-262) **Study on the kinetics of kerogen pyrolysis by means of pressure differential scanning calorimetry.** Lu, S. (Beijing United Research Institute of Applied Chemistry and Chemical Engineering (China)); Wang, T.; Shen, D.; Zhang, Y.; Qin, K. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Chemical structures of oil shales kerogens (Type I, II) sampling from Maoming, Fushun and Huangxian, and their artificial thermal-degradation samples (the final degradation temperatures are ranged from 375 to 510°C) have been investigated by means of the Pressure Differential Scanning Calorimetry (PDSC). There are two exothermic peaks in the PDSC spectrum for each kerogen under 1.5 MPa of O_2. According to the integrated intensity of the peaks, the apparent aromaticity of kerogen may be determined. A new investigation of the kinetics of kerogen pyrolysis based on the aromatic-aliphatic carbon distribution in the kerogen indicates a simplified model of kerogen pyrolysis. The preliminary results of this study show that there is little contribution in oil and gas formation from the aromatic fraction of the original kerogen; the main part of the aliphatic fraction in the original kerogen is readily converted to oil and gas but a little part of it is to the carbonaceous residue. The kinetic parameters of oil and gas generation and of carbonaceous residue formation from aliphatic fraction are studied.

30386 (CONF-880589–, pp. 279-286) **Application of pyrolysis gas chromatography to examination of behavior in retorting of various oil shales.** Ishiwatari, M. (Univ. of Tokyo (Japan)); Sakashita, H.; Tatsumi, T.; Tominaga, H. Colorado School of Mines,

Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Stepwise pyrolysis-gas chromatography for oil shales was carried out with special attention being paid to the effect of pyrolysis temperatures, mineral matter and H_2 atmosphere on the product profile. The sample used for this experiment were Colorado (USA), Condor (Australia), Timhadit (Morocco) and Maoming (China) oil shales and their kerogens. In the early stage of pyrolysis, pyrolyzates rich in alkylbenzenes (Condor and Maoming) or prist-1-ene (and pristane in the case of experiment under H_2) (Colorado) were obtained. Timhadit oil shale gave the pyrolyzates rich in thiophene derivatives in its early stage of pyrolysis. In the advanced stage, pyrograms essentially consisting of a series of olefin/paraffin pairs were obtained with all the shales and kerogens investigated. Pyrolyzates became rich in toluene and benzene with increasing the temperature. Hydrogen seemed to be effective in increasing benzene yield at high temperatures. Various types of linkage in kerogen matrix with different bond dissociation energies should give such variations of product distribution with temperature. Mineral matter may not play a significant role in the kerogen decomposition.

30387 (CONF-880589–, pp. 303-310) **Mechanism of hydrocarbon generation from fushun oil shale kerogen as viewed by high field solid state C-13 n.m.r. spectroscopy.** Qin, K. (Beijing United Research Institute of Applied Chemistry and Chemical Engineering (China)); Wu, X. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Fushun oil shale was pyrolyzed at different final temperatures 400-510°C. The original and pyrolyzed kerogens were measured by high field (75 MHz) solid state C-13 NMR spectroscopy with combination of CP, MAS and TOSS techniques. It provides a high resolution, low distortion and spinning sidebands suppressed spectrum. The carbon distribution and structural parameters derived from NMR measurements have been correlated with relative oil yields. It reveals that the methylene groups are the main matrix of oil and gas, however, the alpha and aromatic carbons contribute little to hydrocarbon generation.

30388 (CONF-880589–, pp. 319-326) **Dependence of the yield and properties of semicoking oils on the mineral content and composition of oil shales.** Urov, K. (Institute of Chemistry, Tallinn (USSR)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Despite numerous investigations on the influence of mineral matter of fossil fuels on the thermal destruction of their organic matter, the data available are scarce and often contradictory. This paper aims at investigating the influence of mineral substances of shales on the yield and composition of shale oils obtained by thermal decomposition in a Fischer retort and by high-rate heating. In experiments natural oil shale samples from different deposits and artificial mixtures were used. The data obtained indicate that it is the adsorption mechanism that influences the yield and composition of semicoking oils, being typical for all mineral components of shales: more polar components are retained on the surface of the solid decomposition residue and are subjected to secondary destruction reactions to give an additional amount of gaseous products and semicoke. The oil yield on kerogen and its density decrease, the oil is enriched with less polar, in particular, aliphatic, hydrocarbons, while the semicoking gas is enriched with carbon dioxide. Unlike carbonates, argillaceous minerals reveal, besides the adsorption effect, also a favorable catalytic effect on oil formation. Therefore it is expedient to enrich some shales, especially those with an appreciable amount of aluminociliates, to some extent only to obtain a maximum oil yield on kerogen. The degree of influence of the same mineral material on the thermal destruction of organic matter of different shales is different and depends on the composition and structure of their kerogen.

30389 (CONF-880589–, pp. 327-334) **Comparison of Fischer assay shale oils produced from different oil shales.** Wu, R. (Daqing Petroleum Institute, Heilongjiang (China)); Chong, S.; Miknis, F.P. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Twelve oil shales from various deposits throughout the world were compared by studying the chemical composition of their Fischer assay-produced oils. Two Chinese oil shales, four US oil shales, two Australian oil shales, two Israeli oil shales, one Turkish oil shale, and one Moroccan oil shale were Fischer assayed to produce shale oils that were then characterized by separation techniques. The oil shales ranged in geologic age from Devonian to Tertiary and represented widely different depositional environments and precursor source materials. Fischer assay oils were fractioned into different compound types before characterization. The isolated fractions were characterized by gas chromatography. In addition, elemental analyses of all shale oils and solid-state carbon-13 nuclear magnetic resonance spectra of the raw shales were obtained for comparison with other results. The Chinese, Green River, Australian and Turkish oil shales, which were of Tertiary age and lacustrine environment, produced more aliphatic shale oils containing larger amounts of both low and high carbon number alkanes. On the contrary, the other six older oil shales, which were of marine sediments, produced more aromatic shale oils containing lower carbon number alkanes.

30390 (CONF-880589–, pp. 345-352) **Fluidized-bed retorting of Australian oil shales.** Dung, N.V. (CSIRO, Menai, New South Wales (Australia)); Udaja, P. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The pyrolysis characteristics of oil shales from eight deposits in Queensland, Australia, were compared using material balance modified Fischer Assays (FA) and a bench-scale fluidized-bed pyrolyzer (BFP). A process variable study was also conducted on Condor and Stuart oil shales using the BFP. Under both FA and steam pyrolysis conditions, a shale having high kerogen hydrogen-to-carbon ratio (H/C) produced high organic carbon conversion to oil and high oil H/Cs. Compared to the FA oil yield, steam pyrolysis produced 15 ± 4% more oil for all shales except Duaringa which yielded a 33% increase. However, steam pyrolysis oils had lower H/Cs and higher sulfur and nitrogen contents than the FA oils. For Condor and Stuart samples, temperatures from 450 to 525 C had little effect on the yields and chemical characteristics of the oils. However, a temperature above 525 C significantly reduced oil yields and increased hydrocarbon gas yields. In the presence of shale ash, oil yields from both nitrogen and steam pyrolysis decreased significantly as the ash-to-shale ratio increased.

30391 (DOE/MC/11076–2684) **Three-phase relative permeability of Asphalt Ridge tar sand.** Sullivan, S.; Vaughn, P. Western Research Inst., Laramie, WY (USA). Aug 1988. 32p. Sponsored by DOE Fossil Energy. DOE Contract FC21-86MC11076. Order Number DE89000964/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Two-phase relative permeabilities for Asphalt Ridge tar sand have been measured at 350°F (177°C). This temperature was chosen to obtain data appropriate for simulating high temperature operation. A modified equation of Stone (1973) was then used to calculate three-phase relative permeability from the measured two-phase relative permeability data. The measured two-phase relative permeability data show lower values than were predicted using typical tar sand properties. The estimated three-phase relative permeability values calculated from the measured two-phase data are lower than those values determined from estimated two-phase values. Simulations of the wet-forward tar sand combustion model, using the new three-phase relative permeability values, were compared with previous simulations and experimental data. The new three-phase relative permeability values improved the model's ability to predict experimental results. More experimental data, using three-phase relative

permeability at different temperatures, may further improve model results. 5 refs., 18 figs., 5 tabs.

30392 (DOE/MC/11076–2688) **Heats of dissolution of tar sand bitumen in various solvents.** Ensley, E.K.; Scott, M. Western Research Inst., Laramie, WY (USA). May 1988. 8p. Sponsored by DOE Fossil Energy. DOE Contract FC21-86MC11076. Order Number DE89000960/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The dissolution of tar sand bitumen from a tar sand matrix was examined using three solvents: (1) dichloromethane, a polar-polarizable solvent; (2) toluene, a nonpolar-polarizable solvent; and (3) hexane, a nonpolar-nonpolarizable solvent. The dichloromethane had the highest dissolution energy, followed by toluene, with hexane having the lowest dissolution energy. These data were combined with heat of dissolution of recovered bitumen and heat of wetting of spent sand to calculate the bonding energy between bitumen and the mineral matrix. The interfacial bonding energy between tar sand bitumen and the mineral matrix was found to be in the region of 0 to 0.09 cal/g of bitumen, which is very small. This conclusion may find application in recovery of energy or bitumen from bitumen-wet tar sand deposits. 9 refs., 2 tabs.

30393 (DTH-LET-RE–88-8) **Procedures for reservoir fluid characterization using an equation of state model. Application to fluids in the Danish North Sea.** Soereide, I.; Whitson, C.H.; Reffstrup, J. Danmarks Tekniske Hojskole, Lyngby (Denmark). Lab. for Energiteknik. Oct 1988. 95p. Order Number DE89766843/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

The present report describes the characterization procedures intended for use with a systematic collection and comparison of compositional data, with the longer-term objective to map variations in the hydrocarbon composition in Danish gas condensate and oil reservoirs. The Whitson Gamma distribution model with a splitting of the plus fraction based on a Gaussian quadrature procedure is used with data from Danish gas condensate and oil reservoirs. The report gives a description of some other splitting procedures available and a detailed description of the Whitson procedure is given with examples. Also, a review of the most commonly used methods for property estimation is included. As part of a more general comparison of PVT data, suggested procedures for consistency checks of laboratory PVT data are given. This includes examples of the procedures with PVT data from the TYRA and GORM fields in the Danish North Sea. The characterization procedures described are finally tested with data from the same two fields, and a match to saturation pressures is made with only one matching parameter, the A parameter in the modified Chueh-Prausnitz correlation for hydrocarbon-hydrocarbon binary interaction parameters. (author) 33 refs.

30394 (UCID–21594) **Mechanism of low-temperature water evolution from Green River Formation oil shale.** Oh, M.S. Lawrence Livermore National Lab., CA (USA). Apr 1989. 15p. Sponsored by DOE Fossil Energy. DOE Contract W-7405-ENG-48. Order Number DE89012808/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The water evolved from Green River Formation oil shale (Mahagony Zone) at temperatures between 150 and 400°C as heated at the rate of 4°C/min results from analcime dehydration; and its rate of evolution is affected by the kinetics of dehydration, the transport of water inside and outside oil shale particles, and the equilibrium vapor pressure and the partial pressure of water. A rate equation including the above rate processes is developed, and kinetic parameters for the decomposition reaction are derived. Further experimental work is necessary to test the model rigorously. 10 refs., 4 figs.

0406 Direct Uses and By-products

Refer also to citation(s) 30325, 30326, 30367, 30382, 30412, 30414

30395 (CONF-880589–, pp. 176-178) **Aspects of nonfuel utilization of oil shales based on their oxidation.** Rein, V. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Besides their utilization as fuel, oil shales may find use in nonfuel applications, including processes in which end products are obtained by artificial or natural oxidation. By artificial nitric acid oxidation of the organic matter of kukersite oil shale the aliphatic mono-, di-, tricarboxylic and complex polyfunctional acids are formed, with the latter as a by-product. During weathering of oil shales their organic matter becomes alkali soluble. The alkali soluble compounds are of sapropelic origin and are called humic or sapropelic acids and fulvic acids. So, the weathered and partly alkali soluble oil shales may find use as an organomineral ameliorant and fertilizer.

30396 (CONF-880589–, pp. 179-188) **Electrochemical oxidation of oil shale.** Zhao, Y. (Beijing United Research Institute of Applied Chemistry and Chemical Engineering (China)); Chi, H.; Dai, H. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Huangxian oil shale slurry in alkaline medium was oxidized by electrochemical method to produce some water soluble and water insoluble acids at anode compartment and high purity H_2 as a by-product at cathode compartment. The elemental analysis shows that about 25-50% of the organic carbon in oil shale was oxidized to products. In the gas chromatographic analysis of methyl ester of organic acids obtained from the oxidation shows that the products are composed of normal saturated monocarboxylic acids in range of C_{10}-C_{22}, normal saturated dicarboxylic acids in the range of C_4-C_{24} and other high molecular weight acids. The current efficiency of hydrogen production was approximately 100%. The influences of several experimental parameters of the electrochemical oxidation process, including voltage, pressure, temperature and slurry concentration have been investigated. Some other oil shales were oxidized for comparison with Huangxian oil shale. It has been found that Huangxian oil shale shows better activities. The mechanism of anodic oxidation was investigated preliminarily. It showed that the electrochemical oxidation of oil shale was preferentially taken place in aromatic rings of kerogen.

30397 (CONF-880589–, pp. 235-244) **Thermal decomposition of New Brunswick oil shale.** Karman, D. (Univ. of New Brunswick, Fredericton (Canada)); Hender, B. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The oil shale deposits in New Brunswick have been considered as potential SO_2 sorbents in co-combustion with high sulfur coal. In this study the thermal decomposition of shale samples have been studied by thermogravimetry up to 950 C, to cover the decomposition of both organic and inorganic constituents. Samples from 4 different zones were used in the -75 μm to + 2 mm range with heating rates of 5-20 C/min. Experiments were carried out in N_2 or a simulated combustion gas with N_2, CO_2, O_2 and SO_2. Total weight loss of the samples reaches up to 30% with differing proportions due to organic and inorganic material for samples from different zones. The rate of mass loss shows 2 or 3 maxima, one in the 400-500 C range, and the others around 700 C. The heating rate in the 5-20 C/min range has a small but noticeable effect on the weight loss characteristics. Data reduction methods proposed by previous workers have been utilized to obtain kinetic parameters representing the global weight loss rate. The utility of parameters so derived, in describing behavior in a fluidized bed seems questionable. Current work aimed at obtaining apparent kinetic parameters in a fluidized bed environment is discussed.

30398 (CONF-880589–, pp. 495-505) **Study on the combustion kinetics of Fushun and Maoming shale char particles.** Wang, X. (Beijing Graduate School (China)); Lin, M.; Qian, J.; Zhu, Y. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The combustion kinetics of Fushun and Maoming shale char particles have been studied. The shrinking core reaction with unchanged size for the shale char particle combustion has been verified experimentally. The combustion kinetic model which involves three resistance, i.e., resistances of gas film diffusion, ash layer diffusion and chemical reaction, has been deduced theoretically. The combustion kinetic parameters of the shale char were obtained by using Simplex optimization method with a IBM/PC-XT microcomputer. The experimental values of combustion time were in good agreement with the theoretical values calculated. Calculations were made to estimate the three fractional resistances of char oxidation respectively. The control step begins at gas film diffusion and shifts to ash layer diffusion gradually during the oxidation reaction under the experimental conditions. The chemical reaction resistance is rather small in comparison with the others and can be neglected at high temperature. The relationship between combustion rate and conversion was analyzed in combination with dimensionless reaction time. The reasonable consumption of carbon in shale char has been suggested.

30399 (CONF-880589–, pp. 506-513) **Self-desulphurating characteristics of high sulfur oil shale in fluidized bed combustor.** Fu, Z. (Northeast Institute of Electric Power Engineering, Jilin (China)); Lu, G.; Liu, B. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Experiments on high sulfur oil shale with 1.42-1.49% sulfur and a net heating value of 4857 kJ/kg (or 1160 kcal/kg) whose ash contained 27.72% CaO and 1.28% MgO were performed in a laboratory - scale fluidized bed combustor. The effects of bed temperature, bed pressure drop (or bed height), excess air coefficient and particle diameter on sulfur retention were investigated during the experiments. It is found from the experiments that the oil shale has great capability of self-desulfurating without additional limestone or other sorbents, because of its ash with high CaO content. By changing the operating parameters, the sulfur capture efficiency is in the range of 86% to 99%. The concentration of SO_2 in flue gas varies from 200 ppm to 400 ppm. Among the operating parameters, the bed temperature has the most significant effect on sulfur retention, and the optimal bed temperature is 850°C.

30400 (CONF-880589–, pp. 514-526) **Fluidized bed combustion of Thai oil shale.** Vanichseni, S. (Chulalongkorn Univ., Bangkok (Thailand)); Silapabunleng, K.; Chongvisal, V.; Prasertdham, P. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Fluidized bed combustion of oil shale was carried out in a laboratory scale fluidized bed combustor. The combustion unit design incorporates perforated plate air distributor, screw feeder and hot gas bed-preheating system. The bed is 15-cm in diameter with a freeboard height of 114 cm. Oil shale calorific values were in the range 1500 to 2200 kcal/kg with 60-70% ash content and 1-5% sulfur. The particle sizes of 1.41 and 2.61 mm were established for effective combustion. The fluidizing velocities were in the range 1-3 m/s and the excess air was in the range 40-120%. The bed temperature was 700-950°C and the pressure atmospheric. The fluidized bed combustion of oil shale was successfully carried out with high carbon combustion efficiency. The carbon combustion efficiency is independent of excess air in the range investigated. Both sulfur dioxide and nitrogen oxide emissions were within the EPA limits.

30401 (CONF-880589–, pp. 527-532) **Fluid-bed boiler burning particulate Maoming oil shale.** Chen, Y. (Maoming Petroleum Industrial Corp. (China)); Que, Y. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Fluid-bed boiler burning particular oil shale developed by Maoming Petroleum Industrial Corporation is the first fluid-bed boiler in China, which got appraisal from the Ministry of Petroleum Industry entrusted by State Commission of Science and Technology in 1967. It was recommended for burning low-grade coals. Two scale-up plants of power station fluid-bed boiler burning particulate oil shale with capacity of 35 t/hr were built in Maoming at the end of 1987 and now put into trial operation. Both the 14.5 t/hr and the 35 t/hr boilers are described. Ash can be used in cement production.

30402 (CONF-880589–, pp. 533-535) **Utilization of high-sulfur shale oil in power plant integrated with gasification system.** Vyskubenko, Yu.A. (Institute of High Temperatures of the USSR Academy of Sciences, Moscow); Maslennikov, V.M.; Tsalko, E.A. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The problem of possible ways of utilization of oil shales from the Middle Volga land deposits is being studied in the USSR. The authors have considered a possibility of using high-sulfur shale oil, which is a residue of complex processing of shales, in combined-cycle power plants integrated with a gasification system for demonstration processing of a 180-ton batch of shale oil. The intercycle gasification of sulfur-containing fuels is presently considered worldwide as a promising way meeting the most stringent requirements on harmful emissions of NO_x and SO_2, while increasing the thermal efficiency of steam power plants. The IVTAN has developed basic principles of this technology patented in the USA, BRD and other countries and has made theoretical and design work terminating by building a large demonstrate power generating plant with intercycle gasification, which is mounted at the Dzerzhinsk electric power station. This plant was designed not for shale oil but for residual oil having a 3% sulfur content. The objective of this study was to prove a possibility of using this technology for shale oil as well with practical demonstration of this process. During 24 hours of operation of the plant more than 150 tons of shale oil were processed, in which case the plant capacity was 38,000-45,000 nm^3/hour of purified gas with shale oil consumption of 7-9 t/hour. Under the most favorable operating conditions the efficiency of removal of hydrogen sulfide from the fuel gas was equal to 85%. The gas provided stable combustion in the power plant boiler.

30403 (CONF-880589–, pp. 536-544) **Thermal fatigue cracking of Estonian oil-shale-fired boilers' tubes caused by on-load water deslagging.** Touart, R. (Tallinn Technical Univ., Estonia (USSR)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The results of the research in the field of thermal fatigue cracking on the outer surface of the 12Cr1MoV steel tubes working under the temperature of 400°C in the furnace screen of boilers burning Estonian oil shale are presented. Long-time, non-stop work of the oil-shale-fired boilers is ensured by the regular usage of the highly intensive water deslagging. In the cleaning cycles there arise thermal stresses in the tubes' wall of the heating surfaces thus causing the initiation and development of thermal fatigue cracking on their outside surfaces. On the basis of field testing under actual boiler conditions during 40,000 hours in the oil-shale-fired boiler general regularities have been determined allowing the prognostication for the increase of the thermal fatigue crack length under the conditions of water deslagging system usage. Another fact is also elicited - influence of tubes metal corrosive-erosive wear intensity on the process of cracking on their surface.

30404 (CONF-880589–, pp. 547-551) **Multipurpose use of shale ash and its paragenetic mineral in China.** Tian, G. (Engineering Construction Technology Institute of Petroleum Industry Ministry, Tianjin (China)); Zhou, X.; Han, Z.; Xu, Z.; Li, X. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

In this paper, the ways of multipurpose use of retort residue in Shale Oil Plant, overflow and fly shale ash in power plant and paragenetic mineral of oil shale in Fushun of Lianoning Province and

Maoming of Guangdong Province, the two China oil shale industry bases, are summarized and some producing problems concerned and the new researching results are introduced. The major uses discussed are the manufacture of Portland cements; cement admixtures, light weight aggregates, and bricks, and its use fill material for abandoned coal mines.

30405 (CONF-880589–, pp. 552-558) **Properties of shale ash (taken from the boiling furnace) Portland cement.** Han, Z. (Engineering Construction Technology Institute of Petroleum Industry Ministry, Tianjin (China)); Xiao, Q. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The properties of shale ash taken from the boiler furnaces in Maoming and the characteristics of shale ash Portland cement containing the Maoming shale ash, as an admixture, are investigated systematically in this paper. Through the physical and chemical test, the authors have obtained the high quality shale ash admixture taken from boiling furnace at burning temperature of 850°C to 950°C. The cement with 30% shale ash content possesses the following features. The compressive strength ratio may reach to 75%, it increases about 10% as compared with the reburning shale ash commonly used by Maoming. The coefficient of antichemical attack increases 50% as compared with the controlled specimen, the drying-shrinkage value increases slightly, the water retentivity is excellent, non-corrosiveness to steel reinforcement, fast strength development in later stage.

30406 (CONF-880589–, pp. 559-564) **Investigation on the Portland pozzolana cement with more shale ash content.** Tian, G. (Engineering Construction Technology Institute of Petroleum Industry Ministry, Tianjin (China)); Zhou, X.; Han, Z.; Li, X. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The retort residue abandoned by the shale oil plant of Maoming Petroleum Industry Corporation is burnt again at 800 ~ 1000°C and makes a high activity admixture applied in cement industry. During grinding cement, putting in 40 ~ 50% high activity shale ash as an admixture and adding a king of surface active agent, a Portland pozzolana cement that conforms to the Chinese State Standard is produced. Producing this Portland pozzolana cement with more shale ash produces the better economic and environmental effect and benefits the development of oil shale industry.

30407 (CONF-880589–, pp. 565-572) **Studies on strength and workability of high-strength and flowing concrete utilizing low calcium oil shale ash.** Wang, Z. (Qinghua Univ., Beijing (China)); Lian, H.; Li, M.; Luo, R. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The low calcium oil shale ash is nonreactive by itself, but when it is mixed with cement, the pozzolanic reaction will occur. Blending the shale ash with cement to make up high-strength and flowing concrete have been studied. The results showed that: for the concrete with same W/C ratio, 20-25% of cement could be replaced by shale ash, while the compressive strength of the concrete could be up to 75 Mpa and increased about 20% more than that of unblended concrete. For the fresh concrete, workability was improved also, the slump was 170 mm over, and bleeding and segregation were eliminated. It has been shown that the effect of blended-ash was more markable for the latter period strength of the concrete with lower W/C ratio.

30408 (CONF-880589–, pp. 643-649) **Initiation and development of fluidized-bed boilers for oil shale in China.** Zhao, Z. (Research Institute of Petroleum Processing, Beijing (China)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

In the early 60s, China decided to develop the engineering construction of fluidized-bed combustion boiler (FBB) for burning low grade fuel. After efforts being made, a fully fluidized industrial boiler was constructed in 1965 with a throughput of 300 tons oil shale fines per day (particle size: 0-10mm) and an evaporation rate of 14.5 tons per hour. The production record of 50,000h continuous and stable operation was achieved, thus laying a foundation for utilizing low grade fuel in boilers. Under the guidance of the chemical engineering study on fluidization carried out by scientific research institutions and universities, more than 2000 FBB of diversified process models have been developed and the scaling up tests are underway in the enterprises concerned. The authors think that as the reserves of oil shale and other fossil fuels of low heating value are several times higher than that of oil and natural gas in the world, they are an important pillar of the future energy and building material industries. Many countries in the world used to pay attention to the development of FBB when the world was faced with an energy crisis. However, the development stagnated when the oil price was steeply reduced. At present, as the progress of world modernization is being speeded up and the energy supply is getting shorter and shorter, it can be predicted that in the near future, the FBB for burning low grade fuel is sure to be brought into line again with the program of engineering construction in various countries of the world, which will be given the first priority to develop.

30409 (CONF-880589–, pp. 650-657) **Utilization of Estonian oil shale at thermal power plants.** Ots, A. (Tallin Technical Univ., Estonia (USSR)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

A few problems connected with the utilization of Estonian oil shale in thermal power plants are considered. The main difficulties in oil shale steam-boiler of thermal power plants operation are concerned with the intensive formation of bonded ash deposits on the heating surfaces, as well as their high temperature corrosion and wear. General properties of organic and mineral matter of Estonian oil shale are presented here. Burning characteristics of organic matter, the behavior of some mineral matter components when heated, fouling and high temperature corrosion mechanism of boiler tubes, and some aspects of the arrangement of oil shale boiler heating surfaces are considered.

0407 Health and Safety

Refer also to citation(s) 30335

0408 Marketing and Economics

30410 (CONF-880589–, pp. 7-18) **Prospect of oil shale and shale oil industry.** Hou, X. (China Petrochemical Corp., Beijing). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Since the energy crisis, countries rich in shale oil deposits have shown increasing interest in the investigation of the properties of oil shale, retorting, and processing of the shale oil. This paper gives an overview of the oil shale industry and forecasts its future. Basic research on the geology of oil shale deposits, the structural chemistry of oil shales, and the kinetics of pyrolysis and combustion are described. The paper then discusses the processing and utilization of oil shale, the processing of shale oil, and shale oil cost and crude oil prices.

30411 (CONF-880589–, pp. 19-22) **Ahead of our time.** Gary, J.H. (Colorado School of Mines, Golden (USA)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

This paper presents an overview of the history of the interest in oil shales over the last 24 years, since the first oil shale symposium met. Financing of research programs have been up and down, depending upon the price and supply of petroleum. The author agrees with predictions that state petroleum availability in the early 21st century will make synthetic liquid fuels competitive. The few oil shale processing plants that are operating today are not cost competitive. The author states that research must continue on synthetic fuels.

30412 (CONF-880589–, pp. 159-166) **Potential production of specialty chemicals from oil shale in the United States.** Sinor, J.E. (J. E. Sinor Consultants, Inc., Niwot, CO (USA)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

For the past 20 years, most oil shale development efforts in the US have been focused on large projects, with a potential production of 8000 cubic meters per day or more. With projects of this size, only the markets for petroleum fuels are large enough to accept the shale oil production. Therefore, the emphasis has been on upgrading and refining shale oil to fit those markets. Historically, however, shale oil industries which were established in other parts of the world were able to find or maintain a market position by providing a variety of products. This study examined the historical experiences of oil shale industries around the world, with respect to making and selling specialty chemicals and byproducts rather than fuel products. It then considered the applicability of such experience to the modern-day US industrial economy. It was found that, in contrast to the normal situation, there is an inverse economy of scale. That is, a small-size project can be more profitable than a large one, because small-volume specialty products can be sold for a higher price per ton of shale.

30413 (CONF-880589–, pp. 663-669) **Economic assessment of the Fushun type commercial shale oil plant.** Li, C. (Luoyang Petro-chemical Eng. Co. (China)); Yan, G. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Based on the data of commercial operation of Fushun type retorting technology and pilot study of shale oil upgrading, the economic assessment of a 500,000 t/yr commercial shale oil plant is presented. This plant comprises oil shale retorting and product recovery, fluidized bed combustion of particulate shale, hydrotreating of shale oil and hydrogen manufacturing. Main product of the plant is synthetic crude; sulfur and ammonium sulfate are its by-products. Syncrude may be further processed into liquid fuels by conventional refining processes. The total investment of the shale oil plant of the above mentioned scale is estimated to be 222 MM U.S.D. The cost of syncrude is estimated to be 16.9-24.8 U.S.D/bl, based on the cost of raw oil shale at 1-2 U.S.D/t and the assumed DCF rate of return is 10% and 15% respectively.

30414 (CONF-880589–, pp. 670-678) **Shale oil industry in Maoming.** Shi, G. (Maoming Petroleum Industrial Corp. (China)). Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

In Maoming, oil shale is open pit mined with annual capacity of five million tons oil shale and is retorted with annual production of 100,000 tons shale oil. Two sets of medium pressure boilers of 35 tons steam per hour have been built. A cement works of 80,000 tons annual capacity using shale ash as raw material are in operation. High quality kaolinite overlying oil shale deposits can be used as coating material for paper making. In Maoming, the production cost of shale oil is lower than the cost of crude oil in international market.

30415 (CONF-880589–, pp. 679-685) **Ideas on the development of Maoming oil shale and shale oil industry.** Liang, G. (Research Institute of Petroleum Processing, Beijing (China)); Shi, G.; Yang, Y. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The recoverable reserves of Maoming oil shale deposits are estimated to be 4.17 billion metric tons. The total area of Maoming oil shale mine covers 360 sq. km among which only 6% is being exploited. Currently the production of shale oil in Maoming accounts for 100,000 tons per annum and the high production cost has retarded the further development of shale oil industry. Lowering the production cost of shale oil is a prerequisite for enlivening the shale oil industry. It is suggested to utilize comprehensively the organic mass and minerals in oil shale, the kaolinite in the upper layer as well as the underlying peat besides making high value products from shale oil.

0409 Waste Research and Management

30416 (CANMET–W13GEN-14) **Design operating manual for heavy oil miniplant.** Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1988. 57p. (MICROLOG–89-01722). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A pilot plant has been designed and constructed in Alberta for research related to the treatment of oil/water emulsions and effluent waters produced from in-situ recovery of tar sands and enhanced recovery of heavy oils. The plant's objectives are to design and optimize different processes and process flowsheets; evaluate and improve emulsion separation processes; and test and evaluate new process monitoring and control equipment. This manual is intended to assist operating personnel at the plant and provides operating parameters and equipment specifications, safety aspects, and commissioning and start-up instructions. A section on process/flow description includes information on the plant's feed systems, the free water knockout drum (for primary separation), the dual polarity electrostatic treater and the evaporator (for secondary treatment of produced heavy oil), the induced gas flotation unit (for secondary treatment of produced water), bypass and recycle operations, test loops, and related equipment. 1 fig., 1 tab.

30417 (CONF-880589–, pp. 575-583) **Prevention of oil shale dust explosions.** Hertzberg, M. (Dept. of the Interior, Pittsburgh, PA (USA)); Cashdollar, K.L. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Lean flammability limit concentrations and inhibitor inerting levels were measured for oil shale dusts from the Green River Formation in western Colorado. The inhibitors studied included excess nitrogen (N_2), limestone rock dust ($CaCO_3$), and ABC powder ($NH_4H_2PO_4$). Also studied were the effects of varying particle size and the influence of the addition of a small percentage of methane gas to the dust-air mixtures. For hazard assessment purposes, the results obtained in these studies are systematically compared with the data obtained for Pittsburgh seam bituminous coal dust. The data show that the dominant factor in determining flame propagation and explosion behavior is the combustible volatile content of the dusts. The measured lean limits of flammability vary inversely with oil assay, and all grades of shale dust with Fischer assays greater than approximately 20 gal/ton are capable of propagating dust explosions in air at concentrations in excess of their lean limits. With excess nitrogen addition to the air, a minimum oxygen level is reached below which flame propagation is impossible. That minimum O_2 level ranges from 18% for the 20 gal/ton dust to 12% for the 50 gal/ton dust. The addition of $CaCO_3$ or $NH_4H_2PO_4$ dust to the oil shale also results in total inerting when the total incombustible content of the mixture exceeds about 87 to 91% by weight; or alternatively, when the combustible volatile content of the mixture is less than 9 to 13% by weight. The inerting effectiveness of the $NH_4H_2PO_4$ is somewhat better than that of the $CaCO_3$.

30418 (CONF-880589–, pp. 593-602) **Identification and treatability of organics in the waste water from oil shale retorting units.** Yao, M.; Xie, D. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

This paper reports a unique series of treatments including solvent extraction with trichlotrifluorethane, adsorption with activated carbon and ion-exchange resins to separate organics from Fushun and Maoming retort waters. The extracts were identified by capillary column GC-MS analysis. The results show that main part of the organics are normal carboxylic acids, phenols, alkyl pyridines, piperidines, pyrroles and cyclic saturated and unsaturated ketones. The studies of the treatability indicate that treatment with activated carbon can remove much of the non-biodegradable organics, thus significantly improve the biodegradability of the treated water.

30419 (CONF-880589–, pp. 603-610) **Industrial testing of retorting waste water treatment in towered biological filtration pond.** Cai, M. (Maoming Petroleum Industrial Corp. (China)); Jin, K.; Zhu, Z.; Yi, B.; Ye, Q. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

Retorting waste water is first pre-treated by static sedimentation, oil interception, flocculation, air flotation, then undergoes biological treatment in towered biological filtration pond. COD, BOD, volatile phenols, hydrocarbon contents can be greatly reduced and the waste water discharge in Maoming Petroleum Industrial Corporation can meet environmental standards. The treatment cost is lower than conventional refinery treatment, which makes towered filtration pond a promising equipment.

30420 (DOE/LC/11062–2660) **Acid mine drainage potential of raw, retorted, and combusted Eastern oil shale: Final report.** Sullivan, P.J.; Yelton, J.L.; Reddy, K.J. Western Research Inst., Laramie, WY (USA). Sep 1987. 122p. Sponsored by DOE Fossil Energy. DOE Contract AC21-85LC11062. Order Number DE89000909/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

In order to manage the oxidation of pyritic materials effectively, it is necessary to understand the chemistry of both the waste and its disposal environment. The objective of this two-year study was to characterize the acid production of Eastern oil shale waste products as a function of process conditions, waste properties, and disposal practice. Two Eastern oil shales were selected, a high pyrite shale (unweathered 4.6% pyrite) and a low pyrite shale (weathered 1.5% pyrite). Each shale was retorted and combusted to produce waste products representative of potential mining and energy conversion processes. By using the standard EPA leaching tests (TCLP), each waste was characterized by determining (1) mineralogy, (2) trace element residency, and (3) acid-base account. Characterizing the acid producing potential of each waste and potential trace element hazards was completed with laboratory weathering studies. 32 refs., 21 figs., 12 tabs.

0410 Environmental Aspects

Refer also to citation(s) 30420

30421 (CONF-880589–, pp. 592) **Sorption of pyridine and quinoline onto rundle spent shale.** Zhu, S. (Univ. of Queensland (Australia)); Bell, P.R.F.; Greenfield, P.F. Colorado School of Mines, Golden, CO (USA). 1988. From International conference on oil shale and shale oil; Beijing, China; 16-19 May 1988. In *International conference on oil shale and shale oil; Proceedings.* Order Number DE89010445/JAW. Available from NTIS, PC A 99; 3.

The single and binary sorption of pyridine and quinoline from aqueous solutions onto Rundle spent shale have been investigated in detail. The results show that the adsorption isotherm for either pyridine or quinoline is of Langmuir type (L-4). The adsorption is sensitive to pH with a maximum adsorption at about pH4, the curve of adsorption vs pH shows a typical profile. For the bisolute adsorption, pyridine does not affect the adsorption of quinoline, while quinoline slightly affects the adsorption of pyridine. All of the isotherms for the bisolute adsorption are of Langmuir type (L-4). At the relatively low concentrations of quinoline and pyridine found in oil shale retort water, the Langmuir equation for single adsorption can be used directly to predict the binary adsorption profile. Mechanisms of adsorption of both species are proposed and discussed in some detail. The results provide fundamental insight into the mechanisms likely to control the transport of N-heterocyclic compounds in spent shale waste dumps.

30422 (PB–89-159149/XAB) **UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. First quarter 1988. Report for 1 January-31 March 1988.** Unocal Corp., Parachute, CO (USA). Energy Mining Div. 31 May 1988. 458p. (REPT–88-1Q). Available from NTIS, PC A20/MF A01.

See also PB–89-147284.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The support agreement included development of an Environmental Monitoring Plan incorporating existing compliance monitoring and supplemental monitoring on water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1986-1993. Twenty-two supplemental monitoring sites have been designated, to date. This report describes ambient and source compliance data collected during the quarter, progress in performance monitoring, certification for air quality, monitoring audits, and initial industrial hygiene supplemental monitoring.

30423 (PB–89-159156/XAB) **UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. Second quarter 1988. Report for 1 April-30 June 1988.** Unocal Corp., Parachute, CO (USA). Energy Mining Div. 31 Aug 1988. 718p. (REPT–88-2Q). Available from NTIS, PC A99/MF E04.

See also PB–89-159149.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The support agreement included development of an Environmental Monitoring Plan incorporating existing compliance monitoring and supplemental monitoring on water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1986-1993. Twenty-two supplemental monitoring sites have been designated, to date. The report includes compliance operational monitoring data, ambient and source compliance data collected the previous quarter, and results of the industrial hygiene monitoring during the first quarter, 1988. Four pages of text precede over 718 pages of data sheets.

30424 (PB–89-159164/XAB) **UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report, third quarter, 1988. Report for 1 July-30 September 1988.** Unocal Corp., Parachute, CO (USA). Energy Mining Div. 30 Nov 1988. 568p. (REPT–88-3Q). Available from NTIS, PC A24/MF A01.

See also PB–89-159156.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The support agreement included development of an Environmental Monitoring Plan incorporating existing compliance monitoring and twenty-two supplemental monitoring points for water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1986-1993. This report contains results of industrial hygiene monitoring, operational compliance monitoring, monitoring audits, and a description of the first supplemental sampling campaign.

30425 (PB–89-159172/XAB) **UNOCAL Parachute Creek Shale Oil Project. Monitoring review committee meeting report. Annual meeting, 1987-1988.** Unocal Corp., Parachute, CO (USA).

Energy Mining Div. 25 May 1988. 77p. Available from NTIS, PC A05/MF A01.

See also PB–89-159164.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic fuels plants. The Parachute Creek Shale Oil Program is one of four projects awarded financial assistance. The support agreement included development of an Environmental Monitoring Plan incorporating existing compliance monitoring and twenty-two supplemental monitoring points for water, air, solid waste, worker health and safety, and socio-economic impacts during the period 1986-1993. A Monitoring Review Committee (MRC) comprised of representatives from the Project, U.S. Department of Treasury, U.S. Department of Energy, U.S. Environmental Protection Agency, and the state convene each year to discuss monitoring information and trends in environmental and health surveillance. This report documents the first annual MRC meeting, held at the Project.

05 NUCLEAR FUELS

Refer also to citation(s) 30991, 31447, 31448

0501 Reserves, Exploration, and Mining

Refer also to citation(s) 30620, 30623, 31390, 31391, 31828, 31991

0504 Feed Processing

30426 (FMPC/Sub–014) **Metallurgical evaluation of FMPC Vessel No. 2.** Bagnall, C.; Wise, W.N. Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center; Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div. Mar 1989. 155p. Sponsored by DOE Defense Programs. DOE Contract AC05-86OR21600. Order Number DE89012771/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

A major purpose of this evaluation program was to accumulate information on the behavior and properties of a vessel at the Feed Materials Production Center, fabricated of Monel 400, after service exposure in a UF_6–UF_4 reduction tower. These data will then be used to aid in the formulation of an equation to predict remaining life for the vessels. In addition, data from this destructive evaluation will provide information on the reliability of the reaction vessel surveillance program currently in operation at FMPC. After 1400 h of operation, Vessel No. 2 was removed from service and assigned to this program for extensive study. The report describes an initial survey of the physical condition of the vessel, provides details of the sampling plan, and then proceeds to document information in the various areas of investigation. These include radiography, chemical analysis, and mechanical properties over a temperature range up to 1800°F. Metallographic studies from six key locations of the reaction vessel were conducted; major weld areas and selected tensile specimens were also examined. The report continues with a summary of the findings and a discussion of key aspects in relation to pertinent literature. The final section of the report provides conclusions drawn from evaluation of Vessel No. 2, and sets forth recommendations related to fabrication and extension of its operating life. 12 refs., 43 figs., 16 tabs.

30427 (INIS-BR–1454) **Advantage of uranium contained in low grade dolomite ore.** Carneiro, A.L.M. Associacao Brasileira de Metais, Sao Paulo, SP (Brazil). 1988. 17p. (In Portuguese). (CONF-8809333–: 13. national meeting on mineral treatment and hydrometallurgy, Sao Paulo, Brazil, 26-29 Sep 1988). Order Number DE89613116/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The purpose of this work is to investigate a technological route to recover uranium from a lean mineral ore. The experimental work includes studies concerning calcination, carbonate leaching, settling, filtration and resin-ion-exchange. Experimental data confirm the technological feasibility of the proposed process and two different preliminary flowsheets of a pilot plant were suggested.

30428 (INIS-BR–1458, pp. 162) **Trace uranium analysis by isotope dilution alpha and mass spectrometry and comparison with other techniques.** Shihomatsu, H.M. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Iyer, S.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

URANIUM 233/alpha spectroscopy; URANIUM 233/isotope dilution; URANIUM 233/mass spectroscopy; URANIUM 235/alpha spectroscopy; URANIUM 235/isotope dilution; URANIUM 235/mass spectroscopy; GEOCHEMISTRY; ISOTOPE RATIO

30429 (INIS-BR–1532) **Acid lixiviation of phophorite minerals for uranium extraction.** Linzama, H.; Rivas, J. Associacao Latino-Americana de Metalurgia e Materiais, Rio de Janeiro, RJ (Brazil). 1988. 7p. (In Spanish). (CONF-8811214–: 3. Latin-American colloquium about fatigue and fracture of materials, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1988). Order Number DE89613223/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Lixiviation studies of the phosphorite mineral, found in the north of Chile, using sulfuric acid solutions are described. These minerals contain 62.0 ppm of Uranium, 24% of Silice, 18.9% of P/sub 2/O/ sub 5/and other metal-oxides. The influence of the acid concentration, the amount of acid used, granulometry, and the lixiviation yield as a function of the H/sub 3/PO/sub 4/and uranium concentrations was evaluated. In addition, the thermodinamic parameters of the lixiviation process were also evaluated.

30430 **Study of the INER process for uranium recovery from wet-process phosphoric acid.** Ju, S.J. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)); Chiu, T.M.; Hoh, Y.C. *Separation Science and Technology (USA),* 23(12-13): 1297-1309 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The effects of process parameters on the performance of the INER process for recovery of uranium from wet-process phosphoric acid were studied via pseudo dynamic simulation technique. The process parameters investigated include the organic-to-aqueous flow ratio, the aqueous feed-to-stripping agent flow ratio, stage configuration and flow arrangement. The flow arrangements concerned include countercurrent, crosscurrent, and alternating extraction and stripping. The calculated results are in good agreements with the pilot plant data. An improvement of the process performance based on simulation results was also proposed.

30431 **Recovery of plutonium and americium from chloride salt wastes by solvent extraction.** Reichley-Yinger, L. (Argonne National Lab., IL (USA)); Vandegrift, G.F. *Separation Science and Technology (USA),* 23(12,13): 1409-1421 (Oct 1988). DOE Contract W-31-109-ENG-38. (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Plutonium and americium can be recovered from aqueous waste solutions containing a mixture of HCl and chloride salt wastes by the coupling of two solvent extraction systems: tributyl phosphate (TBP) in tetrachloroethylene (TCE) and octyl(phenyl)-N,N-diisobutyl-carbamoylmethylphosphine oxide (CMPO) in TCE. In the flowsheet developed, the salt wastes are dissolved in HCl, the Pu(III) is oxidized to the IV state with $NaClO_2$ and recovered in the TBP-TCE cycle, and the Am is then removed from the resultant raffinate by the CMPO-TCE cycle. The consequences of the feed solution composition and extraction behavior of these species on the process flowsheet design, the Pu-product purity, and the decontamination of the aqueous raffinate from transuranic elements are discussed.

0505 Uranium Enrichment

Refer also to citation(s) 31864

30432 (K/ITP–269/P1) **Fundamentals of uranium enrichment: Part 1, Separation theory: Nuclear fuel cycle training course.** Oak Ridge National Lab., TN (USA). May 1989. 182p.

Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE89011788/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This 5-day training course (i.e., 18 classroom hours and additional hours of out-of-class preparation) on uranium isotope separation has been developed as part of Martin Marietta Energy Systems, Inc., support to the Nuclear Plant Program (NPP). Its purpose is to introduce theoretical and practical aspects of uranium isotope separation with emphasis on methods for cascade analysis; current and historical isotope separation processes are included. An improved mutual appreciation for techniques of data analysis will benefit the mission of the NPP. Training course objectives are (1) to provide and to illustrate the use of mathematical tools for cascade analysis, (2) to provide details of gaseous diffusion and centrifuge methods, and (3) to review worldwide processes for uranium isotope separation. 11 refs.

30433 (K/ITP–269/P3) **Fundamentals of uranium enrichment: Part 3, Advanced separation theory: Multicomponent isotope separation: Nuclear fuel cycle training course.** Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div. May 1989. 40p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE89011790/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This 5-day training course (i.e., 18 classroom hours and additional hours of out-of-class preparation) on uranium isotope separation has been developed as part of Martin Marietta Energy Systems, Inc., support to the Nuclear Plant Program (NPP). Its purpose is to introduce theoretical and practical aspects of uranium isotope separation with emphasis on methods for cascade analysis; current and historical isotope separation processes are included. An improved mutual appreciation for techniques of data analysis will benefit the mission of the NPP. Training course objectives are (1) to provide and to illustrate the use of mathematical tools for cascade analysis, (2) to provide details of gaseous diffusion and centrifuge methods, and (3) to review worldwide processes for uranium isotope separation.

30434 (K/ITP–269/P4) **Fundamentals of uranium enrichment: Part 4, Other methods; foreign activities: Nuclear fuel cycle training course.** Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div. May 1989. 103p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE89011791/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This 5-day training course (i.e., 18 classroom hours and additional hours of out-of-class preparation) on uranium isotope separation has been developed as part of Martin Marietta Energy Systems, Inc., support to the Nuclear Plant Program (NPP). Its purpose is to introduce theoretical and practical aspects of uranium isotope separation with emphasis on methods for cascade analysis; current and historical isotope separation processes are included. An improved mutual appreciation for techniques of data analysis will benefit the mission of the NPP. Training course objectives are (1) to provide and to illustrate the use of mathematical tools for cascade analysis, (2) to provide details of gaseous diffusion and centrifuge methods, and (3) to review worldwide processes for uranium isotope separation.

0507 Fuels Production and Properties

Refer also to citation(s) 30845, 30848, 31805, 32495, 32497, 32499, 32502, 32690, 32691, 32784

30435 (INIS-mf–11430) **Study of fission gases behaviour in the Romanian UO/sub 2/.** Gheorghiu, E. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 23p. (In Romanian). Order Number DE89617073/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

Using some specific experimental techniques, some aspects of the behaviour of fision gases in the Romanian UO/sub 2/are evaluated.

30436 (INIS-mf–11431) **Modeling of the behaviour under irradiation of the nuclear fuel containing thorium, uranium and plutonium oxides.** Budan, O. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 25p. (In Romanian). Order Number DE89617074/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

From the point of view of the behaviour under irradiation of the nuclear fuel the paper analyzes problems concerning the growing of the burn up.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 31396, 31420, 31473

30437 (CEA-CONF–9760) **Last improvements of the DTC 1000 spectrophotometer.** Blanc, F. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif. 1988. 23p. (In French). (CONF-8803210–: Technical meeting on on-line analytical control, Cadarache, France, 10-11 Mar 1988). Order Number DE89770502/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The DTC 1000 spectrophotometer, based on optical fibers and photodiode array was developed for Pu(IV) measurement in fuel reprocessing. The apparatus takes advantage of experience acquired in optical fibers instrumentation and of the study of gamma radiation effects on fibers. This paper give the complete evolution of these last months (memory, hardware, software, background noise). But the principle of the apparatus and examples of results obtained on americium and plutonium on a previous version of the apparatus are recalled. 17 figs., 6 refs.

30438 (CONF-860905–Vol.1, pp. 583-592) **Remote maintenance for waste handling: application of servomanipulators to a new generation of hot cells.** Feldman, M.J. (Oak Ridge National Lab., TN (USA)); Grant, N.R.; Herndon, J.N. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. DOE Contract AC05-84OR21400. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

For several years the Consolidated Fuel Reprocessing Program at the Oak Ridge National Laboratory has been developing facility concepts, designing specialized equipment, and testing prototypical hardware for reprocessing spent fuel from fast breeder reactors. The major facility conceptual design, the Hot Experimental Facility, was based on total remote maintenance to increase plant availability and to reduce radiation exposure. This thrust included designing modular equipment to facilitate maintenance and the manipulation necessary to accomplish maintenance. Included in the design repertoire was the development effort in advanced servomanipulator systems, a remote sampling system, television viewing, and a transporter for manipulator positioning. Demonstration of these developed items is currently ongoing, and the technology is available for applications where production operations in highly radioactive environments are required.

30439 (CONF-860905–Vol.1, pp. 596-606) **Application of lasers to CANDU nuclear fuel reprocessing.** Woodall, K.B. (Ontario Hydro Research Div., Toronto (Canada)); Mannik, L.; Morrison, H.D. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A study has been made of the application of lasers to CANDU nuclear fuel reprocessing. The authors looked for ways to reduce the costs or to improve the safety and efficiency of reprocessing spent nuclear fuel. Among the areas adopted for further investigation were fuel decladding and process monitoring. These studies were initiated as part of a program of assistance to AECL in which the goal was to develop a reprocessing procedure specifically for CANDU fuel which would take advantage of the lower burnup and the lower levels of fissionable materials in the fuel in order to reduce costs. (27 references).

30440 (CONF-890604–1) **Criticality experiments with a mixed oxide fuel pin array in plutonium-uranium nitrate solutions.** Lloyd, R.C.; Smolen, G.R.; Matsumoto, T. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Annual meeting of the American Nuclear Society; Atlanta, Georgia, USA; 4-8 Jun 1989. Order Number DE89006634/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A series of critical experiments was completed with an array of mixed oxide fuel pins surrounded by plutonium-uranium nitrate solutions. The objectives of these experiments are to provide criticality data for a heterogeneous system of fuel pins moderated with plutonium-uranium solutions, and to determine the effectiveness of soluble gadolinium as a neutron absorber for criticality control in optimizing the physical size of equipment. Experiments have been performed in a similar configuration, however, these new experiments provide criticality data for a tighter fuel lump spacing, where soluble neutron poisons are not as effective. 4 refs., 1 fig., 1 tab.

30441 (DP-MS–88-218) **Determination of neptunium by controlled-potential coulometry.** Holland, M.K.; Dorsett, R.S. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant. 1989. 21p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001;AC09-89SR18035. (CONF-890617–1: 2. Karlsruhe international conference on analytical chemistry in nuclear technology, Karlsruhe, Germany, F.R., 5-9 Jun 1989). Order Number DE89011627/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The capability for reliable neptunium-237 measurement is important for nuclear material reprocessing and production. The Savannah River computer-controlled, controlled-potential coulometer has been successfully applied to the measurement/characterization of pure neptunium solutions. The definitive measurement capability achieved is especially important because of the lack of a neptunium primary reference material. The coulometer is calibrated electrically based upon Ohm's Law, Faraday's Law, and the Nernst Equation, and two measurement methods are used. A neptunium measurement, which uses an electrochemical oxidation state adjustment, nitric acid supporting electrolyte, and a gold stationary electrode, was developed by the authors and automated. The neptunium measurement methodology that uses ceric ion oxidation state adjustment sulfuric acid supporting electrolyte and a platinum stationary electrode was automated for use as a second, confirmatory measurement method. Measurement reliability of 99.9% has been demonstrated. The significant aspects of these development efforts are discussed. 16 refs., 2 tabs.

30442 (KFK–4502) **On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers.** Porta, J.J. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Isotopentechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung; Stuttgart Univ. (Germany, F.R.). Fakultaet 13 - Verfahrenstechnik. Mar 1989. 234p. (In German). (PWA–17/89). Order Number DE89774751/JAW. Available from NTIS (US Sales Only), PC A11/MF A01.

A radiotracer measuring technique is presented, by means of which the convective fluid velocity and the intensity of mixing in each one of the two fluid phases, as well as the dispersed phase holdup can be determined and monitored on-line without disturbing the process. A mathematical treatment of the experimental RTD data based on the linear systems theory for the determination of the mixing parameters leads to integral equations whose solution represents an ill-posed problem. The usual approach for the direct solution of the mixing problem by means of the numerical optimization of a parametrical model leads to interpretation errors. The reasons for this are discussed in the present report. An alternative FFT method for the solution of the convolution equation is presented. Through this method, together with a non-parametrical statistical test, it is possible to determine the limitations of frequently used axial dispersion models for the design of pulsed extraction columns. This model fails in the description of the experimentally observed fluiddynamical behaviour of the dispersed phase. An alternative stochastical mixing model is suggested which fits the RTD data of both phases. On the basis of a statistical design, the main effects and interactions of the total flow rate, phase ratio, pulse amplitude and frequency on the afore mentioned fluiddynamical variables for the 3N HNO/sub 3//30% TBP - kerosene system are analyzed with two of the most common plate geometries (sieve and nozzle plates) found in the reprocessing of nuclear fuels. The experiments show a marked effect of the plate geometry on the analyzed variables. They refute also the admissibility of the generalized practice of representing the dispersed phase holdup and the intensity of mixing depending on the product of pulse amplitude and frequency as a determining factor of the fluid dynamics in a pulsed extraction column.

30443 Potentiality of nonorganophosphorus extractants in chemical separations of actinides. Musikas, C. (CEA-IRDI-DERDCA-DGR-SEP-SCPR, Fontenay-Aux-Roses (France)). *Separation Science and Technology (USA)*, 23(12-13): 1211-1226 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

To limit the amounts of radioactive wastes coming from actinide separations by solvent extraction, completely incinerable extractants are desirable. This paper deals with the prospects offered by N,N-dialkylamides, as alternatives to TBP for irradiated nuclear fuels reprocessing and by N,N'-tetraalkyl 2-alkylpropane diamides as actinide extractants from radioactive wastes solutions. The selection of N,N'-dialkylamides based on the solubility of the nitrato-uranyl amide complexes in aliphatic hydrocarbons is presented. The extract chemistry of the main metallic ions present in irradiated nuclear fuels nitrate solutions is discussed as well as the hydrolysis and radiolysis of these extractants. Results of a bench scale test for a first reprocessing cycle shows the reason for interest in the N,N-dialkylamides as substitutes for TBP. The extraction of the main metallic species contained in actinide wastes by N,N'-tetraalkyl,2-alkylpropane diamide is presented. The results show that these diamides present good prospects, for removing the actinides contained in various wastes solutions.

30444 Restoring solvent for nuclear separation processes. Rief, D.J. (E.I. du Pont de Nemours and Company, Aiken, SC (USA)). *Separation Science and Technology (USA)*, 23(12-13): 1285-1295 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Solvent extraction separation processes are used to recover usable nuclear materials from spent fuels. These processes involve the use of an extractant/diluent (solvent) for separation of the reusable actinides from unwanted fission products. The most widely used processes employ tributyl phosphate as an extractant diluted with a normal-paraffin hydrocarbon. During use, the solvent is altered due to hydrolysis and radiolysis, forming materials that influence product losses, product decontamination, and separation efficiencies. In most processes, the solvent is recycled after cleaning. Solvent cleaning generally involves scrubbing with a sodium carbonate solution. Studies at the Savannah River Laboratory have shown that carbonate washing, although removing residual solvent activity, does not removed more solvent-soluble binding ligands (formed by solvent degradation), which hold fission products in the solvent. Treatment of the solvent with a solid adsorbent after carbonate washing removes binding ligands and significantly improves recycled solvent performance. Laboratory work to establish the advantage of adsorbent cleaning and the development of a full-scale adsorption process will be described. The application of this process for cleaning the first cycle solvent of a Savannah River Plant production process will be discussed.

30445 Effect of uranium on third phase formation in the Pu(IV)-HNO_3-TBP-dodecane system. Srinivasan, T.G. (Indira Gandhi Centre for Atomic Research, Tamil Nadu (India)); Dhamodaran, R.; Vasudeva Rao, P.R; Mathews, C.K. *Separation Science and Technology (USA)*, 23(12-13): 1401-1408 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Third phase formation is an important phenomenon which must be taken into account while designing flow sheets for fast reactor

fuel reprocessing, since this phenomenon limits the plutonium loadings in the Tri-n-Butyl Phosphate(TBP) phase. In an earlier paper, the limiting organic concentration (LOC) of Pu(IV) above which third phase formation occurs was reported for the Pu(IV)-HNO_3-TBP system. In the present work, the effect of uranium on third phase formation in the Pu(IV)-HNO_3-30% TBP-n-dodecane system was studied in detail at different acidities at 303 K. The LOC decreased with organic loading of uranium at all acidities studied.

30446 Uranium and zirconium mass transfer testing of 5.5-cm-diam centrifugal contactors. DeMuth, S.F. (Oak Ridge National Lab., TN (USA)); Randolph, J.D. *Separation Science and Technology (USA)*, 23(12,13): 1489-1502 (Oct 1988). DOE Contract AC05-84OR21400. (CONF-871038--: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

As part of the Consolidated Fuel Reprocessing Program of the Oak Ridge National Laboratory, compact centrifugal contacts were designed and prototypes build for the Breeder Reprocessing Engineering Test (BRET) facility with a throughput capacity of 0.1 t/d of heavy metals. While the construction of BRET has been put on hold indefinitely, development of the 5.5-cm-diam centrifugal contactors has advanced due to the contactor's broad applicability in other areas of fuel reprocessing and other liquid-liquid extraction. Due to the short residence time of the process fluids in a centrifugal contactor, it was necessary to measure the mass transfer efficiency for a typical process flowsheet. This was done with depleted uranium and ^{91}Zr. The results of mass transfer tests with uranium and zirconium are reported in this paper.

30447 Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid. Nayak, S.K. (Indira Gandhi Centre for Atomic Research, Kalpakkam (India)); Srinivasan, T.G.; Vasudeva Rao, P.R.; Mathews, C.K. *Separation Science and Technology (USA)*, 23(12,13): 1551-1561 (Oct 1988). (CONF-871038--: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The dissolution of carbide fuels in nitric acid leads to the formation of a number of organic compounds which cause serious interference in the subsequent steps of reprocessing. In the present work, the optimum conditions for the photochemical destruction of these compounds by excited uranyl ion were established. The optimum concentration of uranium was found to be in the range 10-45 mg/mL. The destruction rate was found to decrease with increase in acidity. It was established that apart from oxalic and mellitic acids, some other unidentified compounds were also responsible for the interference in solvent extraction.

0509 Transport and Storage

Refer also to citation(s) 30638, 30898

30448 (CONF-890631--1) **UF-6 cylinder overpack phenolic foam drop tests.** Strunk, W.D.; Barlow, C.R. Oak Ridge Gaseous Diffusion Plant, TN (USA). 1989. 2p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OT21400. From International symposium on packaging and transporting of radioactive materials; Washington, D.C., USA; 11-16 Jun 1989. Order Number DE89001049/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

From drop testing of UF-6 cylinder overpack models, a comparison of the mechanical shock absorbing ability of cylinder overpack phenolic foams made from reagent grade and commercial grade chemical has been made. The reagent grade chemicals are specified in US Atomic Energy Commission (now the US Department of Energy) Material and Equipment Specification SP-9. Additionally, comparisons were made from drop testing done on models using the commercial grade chemicals at room temperature (75°F) and at typical minimum temperature (-40°F). The test results demonstrate the mechanical equivalence of the two foam types as well as the ability of the foam to provide reasonable shock protection at low temperatures.

30449 (DOE-RW--88.067) **Evaluation of a prototype air transport system for use in a crate handling and size reduction facility.** Kennedy, S.T. Department of the Environment, London (UK). Sep 1987. 38p. (NRL-R--2002-(S)). Order Number DE89616979/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This paper describes the design features and evaluation, under simulated active conditions, of a purpose designed remotely operated air transporter system. The paper concludes by recommending that an air transporter, based on this concept, is considered for the alpha active facility.

30450 (EPRI-NP--5933, pp. 6.1-6.14) **Update on 1985 and future transportation issues.** Lewis, M.S. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

There were few regulatory changes in 1985, nevertheless, there are many issues the author will discuss that have or will affect the transportation of low-level radioactive material. Some of the changes to the regulations have even made transportation less restrictive. The other issues to be discussed may have more long term effects on the industry, with impacts that can only be predicted. The transportation issues to be discussed include new or changing regulations, cask quality assurance, local transport restrictions, suspected impacts of the Low-Level Waste Policy Amendment Act of 1985, and cost predictions. No other shippers of radioactive material are inspected and regulated as closely as shippers of radioactive waste. Radioactive waste shippers should keep up-to-date.

30451 (SAND--89-0808C) **The risks and consequences from the transport of low specific activity materials by truck.** Finley, N.C.; McClure, J.D.; Cashwell, J.W.; Ostmeyer, R.O.; Wangler, M. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631--15: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013581/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The packaging and transport category of low specific activity (LSA) material was conceived for radioactive materials (RAM) that were considered inherently safe for transport. Such materials could be transported in "strong, tight" packages. The primary concern for the radionuclide content in LSA materials was associated with the potential for inhalation of particulate radioactive material. Thus, the specifications for the category in terms of specific activity were structured to preclude excessive inhalation hazard. The current version of the International Atomic Energy Agency (IAEA) regulations maintains the inhalation-related limits but also shows concern that the restrictions on the LSA category may not preclude an excessive external radiation hazard for gamma-emitting materials. This paper presents the results of an investigation of the potential for such excessive external radiation hazards, particularly for LSA materials with specific activity levels near the current regulatory limit. Analyses are discussed that were performed to evaluate the potential radiological impacts of highway accidents leading to the release of high radiation level-low specific activity (HRL-LSA) materials from their packagings. The results of the analyses are intended to provide a basis for evaluating restrictions on the quantity of gamma-emitting radionuclides that can be contained in an LSA shipment. 8 refs., 2 tabs.

30452 (SRD-R--474) **Transport accident frequency data, their sources and their application in risk assessment.** Appleton, P.R. UKAEA Safety and Reliability Directorate, Culcheth (UK). Aug 1988. 23p. Order Number DE89616980/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Base transport accident frequency data and sources of these data are presented. Both generic information and rates specific to particular routes or packages are included. Strong packages, such as those containing significant quantities of radioactive materials, will survive most of the accidents represented by these base frequencies without a containment breach. The association of severity probability distributions with a base frequency, and package and contents response, leading to the quantification of release frequency and magnitude, are often more important in risk assessment than the base frequency itself. This paper therefore also includes brief

comments on techniques adopted to utilize the base frequencies. This paper reports an accident frequency data survey undertaken at the end of 1986. It has not been updated to take account of work published between January 1987 and the Report publication date.

0510 Marketing, Economics, and By-products

Refer also to citation(s) 30576, 31037

30453 (INIS-mf–11444) **Prospects for Australian involvement in the nuclear fuel cycle.** Chandra, S.; Hallenstein, C. Northern Territory Dept. of Mines and Energy, Darwin (Australia). May 1988. 40p. Order Number DE89617461/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A review of recent overseas developments in the nuclear industry by The Northern Territory Department of Mines and Energy suggests that there are market prospects in all stages of the fuel cycle. Australia could secure those markets through aggressive marketing and competitive prices. This report gives a profile of the nuclear fuel cycle and nuclear fuel cycle technologies, and describes the prospects of Australian involvement in the nuclear fuel cycle. It concludes that the nuclear fuel cycle industry has the potential to earn around $10 billion per year in export income. It recommend that the Federal Government: (1) re-examines its position on the Slayter recommendation (1984) that Australia should develop new uranium mines and further stages of the nuclear fuel cycle, and (2) gives it's in-principle agreement to the Northern Territory to seek expressions of interest from the nuclear industry for the establishment of an integrated nuclear fuel cycle industry in the Northern Territory.

0520 Waste Management

Refer also to citation(s) 30449, 30626, 30630, 30640, 30641, 30822, 30898, 31180, 31217, 31218, 31348, 31382, 31571, 31604, 31606, 32006, 32051, 32071, 32429, 32936, 32938, 32939, 32940, 32941, 32946, 32952

30454 (BNL–42564) **A process for solidifying sodium nitrate waste in polyethylene.** Heiser, J.H. III; Franz, E.M.; Colombo, P. Brookhaven National Lab., Upton, NY (USA). Apr 1987. 26p. Sponsored by DOE Nuclear Energy. DOE Contract AC02-76CH00016. (CONF-870511–7: 4. international hazardous waste symposium on environmental aspects of stabilization-solidification of hazardous and radioactive wastes, Atlanta, Georgia, USA, 3-6 May 1987). Order Number DE89012228/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A laboratory-scale process has been developed for the solidification of nitrate salt wastes in polyethylene. The process uses a commercially available single-screw extruder which continuously discharges prescribed polyethylene-waste mixtures from the hoppers to the output die, where it is extruded into a container while still in the molten form. The molten mixture (~110–120°C) conforms to the shape of the container and solidifies upon cooling. Proportional feeders maintain waste to binder ratio and homogeneity of the waste form. Present studies use dry wastes, although wet solid wastes can be processed using vented extrudes of the type used for the bitumen solidification process. Tests were performed to determine leachability and mechanical stability. Emphasis is placed upon leaching of nitrates from the waste forms. Differential Scanning Calorimetry (DSC) was used to confirm the compatibility of polyethylene and simulated salt wastes at elevated temperatures. Components of the polyethylene/$NaNO_3$ system, alone and in combination, were tested by DSC at temperatures to 400°C. 14 refs., 6 figs.

30455 (BNL-NUREG–42595) **Materials and degradation modes in an alternative LLW [low-level waste] disposal facility.** Cowgill, M.G.; MacKenzie, D.R. Brookhaven National Lab., Upton, NY (USA). 1989. 15p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (CONF-890207–32: Waste management '89, Tucson, Arizona, USA, 26 Feb - 2 mar 1989). Order Number DE89012545/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The materials used in the construction of alternative low-level waste disposal facilities will be subject to interaction with both the internal and the external environments associated with the facilities and unless precautions are taken, may degrade, leading to structural failure. This paper reviews the characteristics of both environments with respect to three alternative disposal concepts, then assesses how reaction with them might affect the properties of the materials, which include concrete, steel-reinforced concrete, structural steel, and various protective coatings and membranes. It identifies and evaluates the probability of reactions occurring which might lead to degradation of the materials and so compromise the structure. The probability of failure (interpreted relative to the ability of the structure to restrict ingress and egress of water) is assessed for each material and precautionary measures, intended to maximize the durability of the facility, are reviewed. 19 refs., 2 tabs.

30456 (CONF-860905–Vol.1, pp. 179-188) **New alternative processes for the treatment of the alkaline solvent wash waste.** Cecille, L. (Commission of the European Communities, Brussels (Belgium)); Cumming, I.W.; Dozol, J.F.; Gasparini, G. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The separate treatment of the solvent wash alkaline waste (ASWW) from the other low- and medium-level liquid wastes generated during reprocessing operations has been investigated through the development of three alternative processes dealing with solvent extraction, chemical precipitation combined with ultrafiltration and inorganic ion exchange. On the basis of lab-scale experiments performed on the same genuine ASWW sample, a comparison has been made between the respective performances of each of these processes in terms of selectivity, decontamination and volume reduction factors. From this assessment, it evolved that solvent extraction and chemical precipitation combined with ultrafiltration processes are good competitors for implementing such kind of treatment although for the alpha DF, solvent extraction appears more flexible. To be really attractive, inorganic ion exchange should exhibit better VRF and DF possibly by pretreating the ASWW.

30457 (CONF-860905–Vol.1, pp. 189-198) **Methods for improved radwaste ion-exchange processing.** Jacob, N.P. (Babcock and Wilcox Co., Lynchburg, VA (USA)); Morgan, E.; Kramer, J.F.; Storton, J.M.; Kangley, J.P.; Robertson, J.R.; Welty, C.S.; Robinson, P.J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

EPRI has sponsored a technical program with the objective of improving radwaste ion-exchange processes to reduce costs associated with ion-exchange materials replacement and disposal. This program applied a methodology of waste characterization, resin selection, and bench and pilot column testing to identify and demonstrate the technical and economic feasibility of an alternative treatment process. All column testing was performed at the site using actual plant radwaste liquid. This process used a combination of zeolite and organic exchange media to successfully treat aerated waste liquid at the Millstone Nuclear Station. The ion-exchange materials used in testing are non-proprietary materials available in good supply and at reasonable cost. This paper discusses the methods used to identify improved processing. These methods will be useful to radwaste operators for selecting and testing their own ion-exchange materials.

30458 (CONF-860905–Vol.1, pp. 199-209) **Electrical processes for the treatment of liquid wastes.** Turner, A.D. (Atomic Energy Authority, Harwell (England)); Bowen, W.R.; Bridger, N.J.; Junkison, A.R.; Cox, D.R. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York,

USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Two electrical processes have been developed to bench-top scale for the treatment of active liquid wastes. Electrokinetic dewatering is an attractive low pressure process for the final stage of slurry concentration prior to immobilization in cement. The electric field induced solid-liquid separation process at a microporous membrane has enabled genuine waste treatment flocs to be concentrated from 5 to 40% solids - with high decontamination factors (DF's). Energy consumptions were only ~ 7% that of evaporation at permeation rates of 0.15-0.3 mh^{-1}. In electrochemical ion-exchange, adsorption and elution at both organic and inorganic exchangers are controlled by an external voltage. While DF's of ~ 2000 are achievable up to 75% loadings of the exchange medium on adsorption, by polarity reversal, elution into water can generate a concentrated product ($\geq$0.25 M) compatible with vitrification. Overall energy expenditure is only 0.3% that for evaporation. This system has been satisfactorily cycled over 2000 times.

30459 (CONF-860905–Vol.1, pp. 210-224) **Improved ion exchange method for treatment of slightly contaminated wastewaters.** Collins, E.D. (Oak Ridge National Lab., TN (USA)); Begovich, J.M.; Brown, C.H.; Campbell, D.O.; Lasher, L.C.; Morris, M.I.; Robinson, S.M.; Scott, C.B. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

An improved method is being developed for the treatment of wastewaters that contain predominantly calcium, sodium, and magnesium bicarbonates and are slightly contaminated with ^{90}Sr and ^{137}Cs. The process decontaminates the water sufficiently for release to the environment while concentrating the radioactive materials into a nonhazardous waste form that can be safely stored with minimum surveillance. The water is passed through a series of columns containing a natural chabazite type of zeolite. The loaded zeolite in discharged columns is dewatered and transferred to a disposal container. Excellent results have been obtained in both partial and full-scale tests. The process is simple, reliable, and economical.

30460 (CONF-860905–Vol.1, pp. 225-230) **Supernatant treatment system at the West Valley Demonstration Project.** Borisch, R.R. (West Valley Nuclear Services Co., Inc., NY (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

This paper discusses the design evolution of the system used at West Valley Demonstration Project (WVDP) to remove cesium-137 from liquid High-Level Wastes (HLW) remaining from PUREX reprocessing of fuel between 1966 and 1972. The Project emphasis is on retrofitting the existing facilities wherever possible instead of building new facilities. Very unique designs have been incorporated into this facility and the incorporation of these designs into a system which contains both old and new facilities has resulted in several unusual construction methods. A brief synopsis of conditions and decisions which lead to today's design is given herein.

30461 (CONF-860905–Vol.1, pp. 231-240) **Strategy and progress in the treatment of LILW in Italy.** Donato, A. (ENEA Cre-Casaccia, Rome (Italy)); Grossi, G.; Venditti, P. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

LLW and ILW radwastes are produced in Italy by nuclear power plants, reprocessing pilot plants, nuclear research centers. Hospitals, universities and industries also appreciably contribute to the overall yearly production. The waste management is at present in charge of the producers, and the wastes are stored at the generation site. The waste management is accomplished according to the Technical Guide N.26, recently emitted by the Italian Regulatory Body (ENEA-DISP), where the criteria to be followed in the management are established. At present no solidification plants are in operation in Italy, less than in the Casaccia Center, where the Nucleco Company solidify the LLW liquid radwastes by means of a mobile MOWA (Nukem) plant.

30462 (CONF-860905–Vol.1, pp. 241-250) **Direct assay of drummed evaporator bottoms, dry active waste, and filter cartridges at the Ginna Nuclear Station.** Cline, J.E. (Science Applications International Corp. (USA)); Bierman, M.R.; Mis, F.J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A direct-assay technique developed by Science Applications assayed solidified evaporator bottoms, dry radioactive waste (DAW) and filter cartridges, contained in drums and HICs, at the Ginna Nuclear Station. The scans measured the average nuclide concentrations over an entire container and accounted for the effects of the concrete. Analysis results from small samples of the homogeneous evaporator bottoms agree with the QuantiScan results to better than 30% for the four drums that were scanned. Measured radiation dose rates agreed closely with dose rates calculated from the concentrations measured in the scans. Scaling factors gave the complete 10CFR61 nuclide concentrations for classification and the shipping manifest. Scans of four containers each of DAW and filter cartridges also agreed with results from sampling and dose-rate measurements. Assays of these latter two waste categories by direct assay are particularly important since representative sampling of these wastes is nearly impossible. The demonstrations showed that the QuantiScan gives fast and accurate assays of bulk waste with no attendant personnel radiation exposure from sampling.

30463 (CONF-860905–Vol.1, pp. 251-262) **Equilibrium leach testing of waste forms containing fuel cladding to evaluate their performance in disposal.** Angus, M.J.; Kirkham, I.A.; Rees, J.H.; Roberts, P.T. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A static equilibrium leach test has been developed to provide a simulation of disposal of intermediate level wastes. The repository components - waste, matrix and backfill - have been equilibrated with water for up to one year. Leachates are analyzed for U, Pu, Np-237, Am-241, Cs-137, Sr-90, Tc-99, I-129 and C-14. Results are presented for leaching from Magnox and advanced gas-cooled reactor fuel cladding wastes using a combination of matrices, backfills and atmospheric conditions. The equilibrium concentrations were generally very low and have been compared with the concentration of each isotope in drinking water that would give an adult an annual dose of 1 mSv.

30464 (CONF-860905–Vol.1, pp. 263-273) **Model B - a new process for solidification of ion-exchange resins and evaporation concentration.** Lindberg, L. (Avfallsprojekt AB, Stocksund (Sweden)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Avfallsprojekt AB is a Swedish company specialized in waste management and processing systems for low- and medium-level waste. Avfallsprojekt has developed a new process, patent pending, called Model B for bitumenization of ion-exchange resin and evaporation concentrate. Model B unites and optimizes the advantages from existing cement and bitumen processes with respect to all aspects in the different waste handling phases. Model B features are high mixing ratio, no risk for fire and simplicity achieved by using a special developed B-emulsion.

30465 (CONF-860905–Vol.1, pp. 274-283) **Long-term prediction of radionuclide leaching from waste matrix by finite-slab approximation method.** Doh, J.Y. (Korea Advanced Institute of Science and Technology, Seoul); Lee, K.J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A finite slab approximation method was developed to predict the long-term leachability. It is based on the assumption that the diffusional characteristics of a waste matrix are not dependent on matrix geometry but dependent on volume to surface ratio (V/S) and diffusion coefficient. Consequently it can be expressed as the solution of the equations obtained from a finite slab with an equal V/S ratio (imaginary diffusion length). The calculational results by the finite slab approximation method have been compared with the results obtained for finite cylinder and sphere with corresponding diffusional analysis. The results of this simple model have showed a good agreement and presented a general applicability for the long-term prediction of the radionuclide leaching behavior.

30466 (CONF-860905–Vol.1, pp. 284-287) **Physical stability of cement encapsulated low level radwastes.** Smeltzer, E.E. (Westinghouse Electric corp., Pittsburgh, PA (USA)); Grant, D.C.; Skriba, M.C.; Cwynar, J.C.; Eisenstatt, L.R. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The low level radioactive wastes being generated at the West Valley Demonstration Project must meet the stability criteria of 10CFR61 and the NRC Brach Technical Position - Waste Form. This paper deals with the results of the stability testing of six of the waste streams. It is concluded that cement can be used to encapsulate these wastes, at volume packaging efficiencies of 60-70%, and easily meet the compressive strength guideline, after each of the physical stability tests.

30467 (CONF-860905–Vol.1, pp. 288-304) **Transportable volume reduction bitumen solidification system from design to operation.** Day, J.E.; Doyle, R.D.; Rastberger, S.B.; Tchemitcheff, E. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

In the early 1980's, Associated Technologies, Inc. (ATI) initiated work on the first Transportable Volume Reduction Bitumen Solidification System (TVR). Over the next several years process, system and module design were enhanced and the TVR-III was developed to be an over-the-road truck transportable unit designed to move onto a plant site, process waste and then move to the next plant site to repeat the process. The TVR-III was developed utilizing ATI's knowledge of US nuclear regulatory requirements and the extensive processing experience of SGN resulting in a unit that meets the following requirements: readily transportable to rapidly respond to client's request for processing services; economically viable while minimizing waste disposal volumes and transportation costs; safely operable in an operating plant environment while minimizing the impact on plant operations. The TVR-III has been fully tested and is operating at the Palo Verde Nuclear Generating Station where it is sharing a portion of the TVR-III's capacity with the Clinton Power Station. The unit is processing wastes as part of a three year contract with Arizona Public Service and a five year contract with Illinois Power Company. This paper discusses the TVR-III from early design through present operation at these two sites.

30468 (CONF-860905–Vol.1, pp. 305-319) **Testing waste forms containing high radionuclide loadings.** McConnell, J.W. Jr. (EG & G Idaho, Inc., Idaho Falls (USA)); Neilson, R.M. Jr.; Rogers, R.D. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Low-Level Waste Data Base Development - EPICOR-II Resin/Liner Investigation Program of the US Nuclear Regulatory Commission (NRC) is obtaining information on radioactive waste during NRC-prescribed tests and in a disposal environment. The investigation is divided into four tasks which address different aspects of waste disposal. Those tasks are resin degradation, resin solidification, field testing, and liner integrity. This paper describes the resin solidification task of that program, including the present status and results to date. 25 references.

30469 (CONF-860905–Vol.1, pp. 320-331) **Fuel pool component sampler as an integral part of a direct assay waste characterization method.** Lee, S.G. (Science Applications International Corp. (USA)); Lubaszewski, R.; Tulodieski, D.B. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A direct assay technique quantitatively assays and characterizes the nuclides (including all 10CFR61 nuclides) present in stored fuel pool components. The technique, based on remote gamma spectroscopy measurements, combines scanning with scaling factors, obtained from direct sample analysis, and dose-rate profiling to give a comprehensive waste analysis of the 10CFR61 nuclides. The development of the fuel pool sampler was necessary in order to obtain material samples for radiochemical analyses as required by the direct assay technique. The fuel pool sampler was designed to remotely acquire surface and bulk samples of stored fuel pool components such as control rod blades, LPRMs, flow channels, vacuum filters, and many other miscellaneous components stored underwater. The development and description of the fuel pool sampler are presented as well as a description of how bulk and surface samples, acquired by the sampler, are used in a direct assay technique for waste characterization.

30470 (CONF-860905–Vol.1, pp. 332-341) **Radwaste processing services - examination of future role.** James, D.W. (Bechtel Power Corp. (USA)); Renfro, L.J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Nuclear utility companies in the US are increasingly contracting for radwaste processing services. The number of companies offering these services and the types of services available have grown rapidly in recent years. A comparison of present value revenue requirements and annual operating costs for twin 1000 MWe BWRs and PWRs for three processing scenarios indicates that contracted resin throwaway service currently offers the least-cost alternative to in-plant or contracted solidification. The radwaste services market is becoming increasingly competitive as new participants and new

products are introduced. Although utility resources are expected to be available for in-plant radwaste system improvements, contract radwaste processing services will continue as an important option.

30471 (CONF-860905–Vol.1, pp. 342-353) **Treatment and handling of intermediate and low level radioactive liquid wastes.** Corbet, A.D.W. (British Nuclear Fuels, Risley (England)); Plumb, G.R. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Recent and planned developments in the treatment and handling of low and intermediate level liquid wastes from a reprocessing plant complex are described and briefly examined in relation to the progressively changing national and international objectives. Some details on the practicability of installed and planned treatment options are considered in terms of the compromise of plant operational and environmental benefits versus complexity, reliability and costs of the processes.

30472 (CONF-860905–Vol.1, pp. 354-366) **Design and fabrication experience with the AZTECH radwaste equipment.** Dillmann, C.W. (General Electric Co. (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

AZTECH is a volume reduction and solidification system for low level liquid waste. This paper describes the detailed design and fabrication of the first generation modular design. Also discussed is the design of follow-on units of a highly mobile configuration.

30473 (CONF-860905–Vol.1, pp. 367-376) **Evaluation of treatment alternatives for wastes from both spent fuel rod consolidation and miscellaneous commercial activities.** Ross, W.A. (Pacific Northwest Lab., Albuquerque, NM (USA)); Schneider, K.J.; Oma, K.H.; Smith, R.I.; Bunnell, L.R. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Alternative treatments were considered for both existing commercial transuranic wastes and future wastes from spent fuel rod consolidation. Waste treatment was assumed to occur at a hypothetical central treatment facility (a Monitored Retrieval Storage [MRS] facility was used as a reference). Disposal of the waste in a geologic repository was also assumed. The waste form characteristics, process characteristics, and costs were evaluated for each waste treatment alternative. The evaluation indicated that selection of a high volume reduction alternative can save almost $1 billion in life-cycle costs for the management of transuranic and high-activity wastes from 70,000 MTU of spent fuel compared to the reference MRS waste treatment processes. The supercompaction, arc pyrolysis and melting, and maximum volume reduction alternatives are recommended for further consideration; the latter two are recommended for further testing and demonstration.

30474 (CONF-860905–Vol.1, pp. 377-392) **Source-term development for commercial low-level radioactive waste.** Godbee, H.W. (Oak Ridge National Lab., TN (USA)); Kibbey, A.H.; Clower, T.J.; Forsberg, C.W.; Storch, S.N. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Generic source terms based on historical data have been developed for commercial low-level radioactive waste (LLRW) from fuel-cycle and non-fuel-cycle facilities. These source terms are used in DOE's Integrated Data Base (IDB) Program to estimate historical and projected volumes, radioactivity, and thermal power (from radioactive decay) of LLRW to the year 2020. Periodically, the source terms are updated as new waste is generated and as information on older waste is reviewed, redfined, and upgraded by the generator. Other segments of the nuclear industry also use source terms in planning for waste treatment, transportation, and storage systems. Several uses of source terms are illustrated. For example, the reported volume and radioactivity of LLRW added annually to commercial burial sites are compared with the calculated annual values obtained by summing contributions based on source terms for each generator. Likewise, accumulative radioactivity and thermal power of buried LLRW obtained by using an average source term and a synthesis of individual source terms are compared.

30475 (CONF-860905–Vol.1, pp. 393-402) **Application of decontamination solution process methods.** Conroy, K.W. (Chem-Nuclear Systems Inc. (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The processing of wastes from chemical decontamination projects has become a routine service. The EPRI sponsored Fuel Decontamination Project presented a challenge not found in other chemical decontamination projects. The Chem-Nuclear systems, Inc., role in this project was to solidify and transport for disposal all wastes generated as a result of the decontamination of two spent fuel bundles. In addition, a formula for solidification meeting the criteria of stable waste under 10 CFR Part 61 was developed. The planning that went into this project as well as the actual project results will be discussed in detail.

30476 (CONF-860905–Vol.1, pp. 403-413) **CEC research programme for treatment and conditioning of spent fuel hulls.** Hebel, W. (CEC, Brussels (Belgium)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The management of the radioactive hulls of spent nuclear fuel is part of the R & D activities which the Commission of the European Communities is supporting in the scope of its shared-cost program on radioactive waste. The R & D activities began in 1976 and have led to a comprehensive characterization of such different fuel hulls as from Light Water Reactors, Fast Breeder Reactors and, for comparison reasons, also from CANDU (heavy water) reactors. With regard to the development of advanced conditioning methods for the long-term storage of hulls' waste, several alternative options were investigated, namely the hulls' compaction and enclosure into a lead containment, the embedment into a compacted graphite or aluminum matrix, the embedment into anhydrous ceramic cements and, on the other hand, the conversion of zircaloy hulls into chemically inert zirconia as well as the conditioning of zircaloy hulls by melting.

30477 (CONF-860905–Vol.1, pp. 414-424) **Management of cladding hulls and fuel hardware.** Kraemer, R. (Kernforschungszentrum Karlsruhe (West Germany)); Frotscher, H.; Graebner, H.; Kapulla, H.; Baehr, W. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara

Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Cladding hulls and fuel hardware represent solid head end waste at the reprocessing plant. The paper describes current practices for conditioning this waste category with cement. A new waste form by cold axial pressing of the material is presented, which may be disposed in a saltmine repository using the same boreholes as used for disposal of HLW-containers. Comparison of the cemented waste form versus the press compacted waste form is evaluated.

30478 (CONF-860905–Vol.1, pp. 425-432) **Mobile supercompaction service for DAW.** McKeehan, E.R. (General Electric Co. (USA)); Dillmann, C.W.; Fallas, T.T.; Kuener, E.L. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A mobile compaction service for processing dry active waste (DAW) using a high force supercompactor called "Superpack" (a trademark of INET Corporation) was started up in the last quarter 1985. The 2200 ton press makes it possible to compact many types of waste previously considered uncompactible (i.e., wood, pipe, valve bodies, and other metallic items). With this capability, it is not necessary to segregate waste, thus reducing the need for procedural controls on packaging. The high volume reduction factor achieved by Supercompaction will result in reduction in burial costs and savings in valuable burial site allocation space or site storage needs. This paper addresses recent changes in regulations, the need for clearly cost effective methods of volume reduction and the need to minimize burial site allocation needs. In addition, the design of the press and the hydraulic control system are covered along with the startup experience.

30479 (CONF-860905–Vol.1, pp. 433-444) **CEGB experience in immobilizing radioactive resins, sludges, and related wastes.** Haigh, C.P.; Willis, A.S.D.; Martin, W.; Vibrans, J.; Williams, J.E.; Curry, A.; Haighton, A.P. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Central Electricity Generating Board (CEGB) is carrying out a program of work with the objective of developing processes and plant for the conditioning of radioactive solid wastes arising at its gas cooled nuclear power stations. The varied nature of the wastes, which include various pond sludges and organic and inorganic ion exchange resins of specific activity up to 40 TBq/m^3 (1000 Ci/m^3 of Cs^{-137}), meant that it was an essential requirement that the plant be designed to use both cementitious and polymeric matrices. This paper outlines development work and the design and operational features of a fixed plant. Some of the important design features are highlighted including the choice of all steel construction, in-drum disposable mixing blade and the use of shielded waste containers. The first plant has been built and operated at Trawsfynydd Power Station and the operational experience gained is summarized. Further development work and applications are outlined.

30480 (CONF-860905–Vol.1, pp. 445-454) **Development and evaluation of polyethylene as solidification agent for low-level waste.** Franz, F.M. (Brookhaven National Lab., Upton, NY (USA)); Colombo, P. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A polyethylene solidification process, using an extrusion system, has been developed for the immobilization of dry wastes resulting from volume reduction technologies. Ease of processibility and high packing efficiencies were obtained through the use of low-density polyethylene (0.917 to 0.924 g/cm^3) with melt indices from 2.0 to 55.0 g/10 min. Maximum waste loadings of 70 wt% sodium sulfate, 50 wt% boric acid, 40 wt% incinerator ash and 65 wt% ion exchange were obtained. A series of tests were conducted to assess the acceptability of polyethylene waste forms to meet the requirements of 10 CFR 61. Based on test results and process control considerations, optimal waste loadings of 70 wt% sodium sulfate, 50 wt% boric acid, 40 wt% incinerator ash and 30 wt% ion exchange resins are recommended.

30481 (CONF-860905–Vol.1, pp. 455-464) **Plant for immobilizing low-level aqueous waste in water extendible polymer.** Williamson, A.S. (Ontario Hydro Research Div., Toronto (Canada)); Husain, A. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A semi-automated prototype plant for immobilizing low-level decontamination wastes in water extendible polymer is described. The plant can process aqueous wastes at the rate of 4 l/min. Immobilization experience with a variety of simulated decontamination wastes is described. In general, conditions of neutral or close to neutral pH, a waste/resin volume ratio of unity and catalyst concentrations up to 3% led to a uniformly cured solid waste form.

30482 (CONF-860905–Vol.1, pp. 465-474) **Immobilization of medium-level waste at Tokai Reprocessing Plant.** Yamanouchi, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)); Yamamoto, M.; Miyao, H.; Takeda, H. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Medium-level liquid wastes generated at the Tokai Reprocessing Plant have been immobilized by a bituminization process for evaporator concentrates and by a plastic solidification process for TBP. The Bituminization Demonstration Facility (B.D.F) and the Solvent Waste Treatment Demonstration Facility (S.W.T.D.F) both of which are located at the Tokai Reprocessing Plant site. The B.D.F adopted the Extruder Solidification Process and has operated with active liquid waste since October 1982. The S.W.T.D.F adopted the Phosphoric Acid Extraction method (KfK method) for separate TBP and, PVC and Epoxy solidification process. Construction of this facility was completed at the beginning of 1984. Cold tests were carried out from May 1984 to October 1985 and hot test began in December 1985.

30483 (CONF-860905–Vol.1, pp. 475-485) **Development and active demonstration of acid digestion of plutonium-bearing waste.** Wieczorek, H. (Kernforschungszentrum Karlsruhe (West Germany)); Oser, B. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

At the Eurochemic site, 800 kg of combustible alpha waste containing about 7 kg of plutonium were treated from March 1983 until July 1985 with the aim to concentrate the plutonium by oxidation of the waste and convert it into a soluble form so that the established purification processes can be applied. The paper describes the process and the equipment used; the results obtained and experience gathered are presented.

30484 (CONF-860905–Vol.1, pp. 486-495) **Juelich Incineration Process for the combustion of hazardous and low level radioactive waste.** Laser, M. (Kernforschungsanlage Juelich GmbH

(West Germany)); Mallek, H.; Jablonski, W. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The JUELICH INCINERATION PROCESS is a controlled air incineration process. The furnace consists of a decomposition chamber and an oxidation chamber, both are separated from each other by a grate. The waste is dried, decomposed and gasified in the completely filled decomposition chamber. In the oxidation chamber the produced gas and unburnt residues are oxidized completely. The temperature in the oxidation chamber is about 900 to 1000°C. In a special version, temperatures up to about 1300°C can be reached. The process can be controlled easily. An off-gas cleaning system which can be specially designed according to the local requirements guarantees to meet all levels prescribed by nuclear and clean air acts. The process has been developed for the combustion of low level radioactive waste containing paper, wood, PE, PVC, ion exchanger resins, carcasses, medical waste, scintillation vials, oil and solvents. It has been installed successfully also for hazardous waste and industrial residues.

30485 (CONF-860905–Vol.1, pp. 496-511) **Licensed centralized low level waste incinerator facility.** Dufrane, K.H.; Arnold, M. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A centralized "Dry Waste Volume Reduction" facility is planned for Battelle's Nuclear Technology Center as a research and demonstration program. The project status of this program is presented along with the incinerator's worldwide operating experience and specialized design features which makes it the most unique incinerator in the world. Key to this latter claim is the research and engineering efforts put forth to obtain an incinerator which emits a clean, easily treatable off-gas along with a minimal amount of secondary waste. This was accomplished by combining a pyrolysis chamber with an excess air combustor to gain the optimum features of each. In the resulting design, gravity feeds the process material into the system's pyrolysis chamber without sorting, shredding or other such pretreatment. Metal objects, liquids, such as oil and gasoline, or solid products, such as resin, blocks of plastic, rubber products, animal carcass, or compacted trash, may be included as normal processed waste. The temperature of this waste is gradually increased from room temperature in an oxygen-depleted atmosphere where volatile pyrolysis gases are produced, tar-like substances are cracked, and the resulting product becomes a relatively uniform and easily burnable material. This material is then introduced into the combustion chamber. Steady burning of this charcoal-like solid material is accomplished under easily controlled excess air conditions with the off-gas then passing through a simple dry clean-up system. The off-gas temperature is reduced prior to passing through secondary and final HEPA filters. The only secondary waste produced are these filters which may be simply re-introduced into the incinerator without any cutting or compaction.

30486 (CONF-860905–Vol.1, pp. 525-533) **Development of a multi-purpose incinerating melter.** Nishino, H. (Chiyoda Chemical Engineering & Construction Co., Ltd., Tokyo (Japan)); Tanaka, Y.; Matsui, M.; Kawakami, M. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Chiyoda is newly developing a Multi-purpose Incinerating Melter, a simple treatment system for a large spectrum of wastes, combustible and non-combustibles, solid and liquid wastes. The incinerating melter is a partially rotating rotary-kiln-type furnace, i.e., oscillating back and forth in an arc of ± degrees during incineration and melting, and then rotated 150 degrees to discharge the molten material. As a result, the wastes are converted directly into glass-like stable solids. Pilot scale tests were conducted with simulated waste compositions and the results are presented in this paper.

30487 (CONF-860905–Vol.1, pp. 534-549) **KEMA incinerator for radioactive waste.** Matteman, J.L.; Eenink, A.H.; Geutjes, A.J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A cyclone incinerator has been developed for the treatment of burnable solid and liquid radioactive wastes at nuclear power stations. The solid waste, shredded to pieces of about 3 cm, is fed to the incinerator continuously suspended in air. Oil and other burnable liquids can be injected into the flame directly. The incinerator is provided with a dry gas-cleaning system; consisting of a spark arrestor, a bag filter and a HEPA filter. During the test phase, over 7000 kg of simulated waste was incinerated at a mean rate of 23 kg/h. Although the heat of combustion of the waste varied during the test runs from 17 MJ/kg (100% paper) to 40 MJ/kg (100% PE) the burnout always appeared to be better than 99.5%. This high incineration efficiency has been obtained through automated control and optimization of process variables like temperature (1175-1275 K) and oxygen content (75-100% excess) in the incinerator. Because the waste feed rate and gas cleaning are also integrated in this control system, the entire installation can be operated by only one employee. The incinerator is made of stainless steel and has no brick lining. Together with the automization this construction allows for very fast start-up and shut-down periods of about 0.5 hours. If desired, the operation can be limited to office hours. The tests with the pilot plant at KEMA were finished in 1985. A demonstration plant is now under construction at the Dodewaard nuclear power station. It is expected that operation will start in the spring of 1987.

30488 (CONF-860905–Vol.1, pp. 550-558) **Economics of PVC incineration.** DaCosta, D.H. (Koch Process Systems Inc., Westborough, MA (USA)); Starr, T.M. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The various alternatives available for the volume reduction of polyvinyl chloride (PVC) in dry active waste (DAW) are compared. Operating costs are calculated to show the extent of capital investment that can be justified with results presented for both BWR's and PWR's at PVC levels of 0-25%. Incineration is shown to be the most attractive alternative at present.

30489 (CONF-860905–Vol.1, pp. 559-566) **Start-up experience and operations of an incinerator and super-compactor.** Bowles, C.R. (Babcock & Wilcox Co., Lynchburg, VA (USA)); Bradley, M.J.; Dam, A.S.; Fogel, D.M. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Babcock & Wilcox Waste Reduction Center (WRC), located in Parks Township, PA, is a commercial, low-level radioactive waste (LLRW) volume reduction facility. The first such commercial facility in the US, the WRC will use both an incinerator and a supercompactor to process dry solids, contaminated oils, liquid scintillation vials, and biological waste from nuclear power plants, institutional facilities and industrial plants. The WRC construction is

essentially complete. An informal hearing on the facility's Nuclear Regulatory Commission (NRC) license amendment application is scheduled for September 30 and October 1, 1986. Commercial operations are scheduled to begin in early 1987, pending the receipt of the necessary licenses and permits. This paper discusses the WRC construction highlights and the recently completed licensing actions with the NRC and the Pennsylvania Department of Environmental Resources (DER). A technical review of the incinerator and super-compactor start-up testing is included.

30490 (CONF-860905–Vol.1, pp. 567-576) **Remote handling features of the PROTEO mock-up facilities for vitrified H.L.W. canisters.** Canonico, A. (ENEA, Trisaia (Italy)); Mataloni, P.; Scoditti, E. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

R & D activity in the vitrification field has been occurring in Italy for several years. An inactive pilot plant (called IVET) had been installed in the late seventies at Trisaia Center for chemical engineering parameters evaluation at full scale of a pot vitrification process. PROTEO plant is a mock-up facility, coupled with IVET, built for studying remote handling operations concerned with the process cycle of a canister from its transfer within the vitrification cell to the interim storage. The operational areas (Station 'A' and 'B'), representing respectively the vitrification and the canister conditioning sections, are the main facilities of the PROTEO. Excluding minor interventions carried out in both Stations by means of a couple M/S type manipulators, all performed operations are completely automatized and controlled by microprocessor devices. This paper deals with facilities and lay-out. Early experimental activities carried out during the year 1985 and operational problems encountered are also described.

30491 (CONF-860905–Vol.1, pp. 577-582) **Progress in the remote handling equipment.** Yamamoto, M. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)); Kashihara, H.; Hayashi, S.; Maeda, M.; Fujita, Y. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Power Reactor and Nuclear Fuel Development Corporation (PNC) is now undertaking the development of new remote maintenance technologies that will be applied to the high-level liquid waste vitrification plant which is also now designed by PNC. This paper presents the development of two arm bilateral servomanipulator system (prototype II manipulator) and radiation hardened high-definition TV.

30492 (CONF-860905–Vol.1, pp. 593-595) **Incorporating functional requirements into the structural design of the DWPF.** Ng, C.K. (Bechtel National, Inc. (USA)); Hsiu, F.J.; Almuti, A.M. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The vitrification building of the DWPF plants is designed to process radioactive defense wastes for future disposal. Special structural consideration and design features were given to the building design to accommodate the unique remote features and requirements of handling nuclear waste within the structure. Innovative ideas and close coordination are required to achieve the requirements of radioactive shielding; remotability and tolerance control; constructibility and functional operations; decontaminability; and structural strength and stability.

30493 (CONF-860905–Vol.1, pp. 512-524) **High temperature slagging incineration - recent operating experience.** Van de Voorde, N. (Belgian Nuclear Research Center, Mol); Hennart, D.; Vanbrabant, R.; Mergan, L. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

In 1974, the Belgian Nuclear Research Center (S.C,K./C.E.N.) at Mol started a research program on the treatment of low-level radioactive waste. The aim was to develop and implement a new high temperature incineration process. With the support of the Commission of European Communities, the technical concept of the High Temperature Slagging Incinerator (H.T.S.I.) has been developed and improved during more than 10 years. The system has been operated successfully and further adapted to enlarge the spectrum of acceptable materials, which now includes highly toxic industrial hazardous wastes. This paper presents the current state of the art of this original concept and the results obtained during the last five exploitation years. A large part is devoted to reporting the operational experience gathered up to now, including problems encountered and remedial actions taken. Finally, the properties of the final waste form are summarized and the suitability for final disposal discussed.

30494 (CONF-860905–Vol.1, pp. 607-615) **Remote handling and size reduction of solid alpha-active waste.** Meredith, B.E. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Handling techniques are reviewed to identify those suitable for adaptation to transporting of large items of plutonium contaminated plant equipment to a remotely operated size reduction facility, moving them into the facility, presenting them to size reduction equipment and loading the processed waste into drums. An integrated system based on a combination of slatted conveyors, roller tables, air transporters and manipulators merits further consideration. Use of lasers to effect size reduction of waste is also considered.

30495 (CONF-860905–Vol.1, pp. 638-648) **Remote process cell mercury transfer pumps for DWPF.** Nielsen, M.G. (Bechtel National, Inc., San Francisco, CA (USA)); Vaughn, V.G. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A method was required to transfer elemental mercury from remote radioactive process vessels. The application presented a number of difficult constraints and special criteria. A survey of available pumps revealed no appropriate candidates. A new pumping method was developed utilizing water displacement. This pump was tested and found to be the simplest and most reliable method of meeting the requirements. A brief review of commercially available pumps, development of present design, test procedures and results are described.

30496 (CONF-860905–Vol.1, pp. 649-655) **Pneumatically operated grapple for handling nuclear waste packages.** Richardson, R.V. (Westinghouse Electric Corp., Madison, PA (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The grapple mechanism is a small but vital component in the handling of nuclear waste packages, at the waste processing facility as well as the repository facility for above ground handling, emplacement, and retrieval of the packages. Many grapple designs have been developed in the industry, some of them specifically for nuclear waste package handling. However, many of them have the drawbacks of being too complex or lacking the flexibility to recover from postulated component failures. This paper presents a pneumatically operated grapple that eliminates those shortcomings.

30497 (CONF-860905–Vol.1, pp. 699-707) **Vitrification plants in France.** Jouan, A. (CEA (France)); Hugony, P.; Maillet, J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

This paper presents the results obtained during the operation by Cogema of the AVM facility at Marcoule, which has vitrified fission products since 1978. It also describes the main features of the six vitrification lines under construction by SGN at La Hague (R7 and T7 facilities). The major directions of the R and D work currently performed by the CEA at Marcoule for the future vitrification facilities are indicated.

30498 (CONF-860905–Vol.1, pp. 708-718) **Windscale Vitrification Plant and vitrified product store.** Woodall, A. (British Nuclear Fuels (England)); Elsden, A.D. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Windscale Vitrification Plant receives highly active liquid waste, which has been conditioned for the vitrification process, from a tank storage complex. The plant provides facilities for feeding forward, calcination, melting, glass pouring, container lid welding, container decontamination, container monitoring and product storage. These mainstream activities are supported by other facilities for off-gas treatment, liquid effluents, inactive feeds and remote replacement of certain process plant. This paper briefly describes the process, the plant, the background history and some of the development and constructional aspects.

30499 (CONF-860905–Vol.1, pp. 719-728) **Hanford Waste Vitrification Plant project: an overview.** Gurley, R.N.; Henderson, J.M.; Shah, K.R.; Scott, J.L.; Allen, C.R. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Rockwell Hanford Operations, a prime operating contractor to the US Department of Energy, has the lead responsibility for the development, design, construction, and operation of the Hanford Waste Vitrification Plant (HWVP). The HWVP is planned to vitrify existing and future liquid high-level wastes produced by defense activities at the Site. The Pacific Northwest Laboratory (PNL) of Battelle Memorial Institute has the support responsibility for providing technology for the waste form and the vitrification system to be utilized in the HWVP. The focus of this paper is on the Vitrification Process and the Design aspects of the HWVP. At the present time, the HWVP is proceeding with Reference Conceptual Design. Definitive design for the HWVP is planned to start in FY 1988. Procurement and construction are planned to start in FY 1989 with hot startup planned for FY 1996.

30500 (CONF-860905–Vol.1, pp. 729-736) **Design experience of PAMELA.** Scheffler, K. (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen (West Germany)); Tittmann, E. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The PAMELA process is characterized by evaporation, calcination and vitrification of the HLW in a ceramic melter, to which the HLW and a basic glass are continuously fed. The molten glass is discontinuously poured through the bottom drain system of the melter into glass block containers suitable for final storage. Planning, erection and commissioning of the PAMELA Plant and the continuous transfer of technology from an extensive development program are described. The coordination of design work with scientific knowledge gained during design, and with demands of the authorities is demonstrated in view of organization, responsibilities and costs.

30501 (CONF-860905–Vol.1, pp. 737-745) **Advances in vitrification techniques in Japan.** Sasaki, N. (Power Reactor and Nuclear Fuel Development Corp., Ibaragi (Japan)); Torata, S.; Igarashi, H.; Kashihara, H.; Yamamoto, M. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Liquid-Fed Joule-Heated Ceramic Melter (LFCM) process for the vitrification of High-Level Liquid Waste (HLLW) is now under development by Power Reactor and Nuclear Fuel Development Corporation (PNC) in Japan. All developmental works are focused on the vitrification plant which is in the stage of design improvement in succession to the detailed design finished in 1984. The construction of the plant will be started in late 1987. Major development items in process technology in recent years are improvements of both the design of a ceramic melter and performance of melter off-gas cleanup system. A new engineering-scale ceramic melter with a 915 MHz microwave heating device has been in operation since September 1985. Melter dismantling technique and numerical flow analysis code and others are also being developed as the part of melter technology. In the off-gas technology, air-film cooler at the outlet of the melter off-gas, high efficiency mist eliminator and wet type electro precipitator were developed and checked on the performance. In the Chemical Processing Facility (CPF), hot vitrification and product characterization works are continued.

30502 (CONF-860905–Vol.1, pp. 746-754) **Pilot plant demonstration of the Defense Waste Processing Facility (DWPF) melter concepts.** Mahoney, J.L. (Savannah River Lab., Aiken, SC (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A production facility to solidify fission waste is being built at the Savannah River Plant (SRP), South Carolina. The Defense Waste Processing Facility (DWPF) will transform SRP high-level radioactive waste into borosilicate glass. At the Savannah River Laboratory (SRL) a pilot plant facility is testing a scaled version of the DWPF melter using simulated nonradioactive waste to verify the concepts selected for use in the melter construction, assembly, and operation.

30503 (CONF-860905–Vol.1, pp. 755-767) **High-level liquid waste treatment: process development studies in the WIPE facility.** Sridhar, T.S. (Atomic Energy of Canada Limited, Pinawa, Manitoba). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986.

In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Canadian Nuclear Fuel Waste Management Program requires that research and development be carried out to establish the technology to treat and immobilize the High-Level Liquid Waste (HLLW) that would arise in future CANDU fuel recycle operations. A pre-industrial scale facility called the Waste Immobilization Process Engineering (WIPE) Facility has been designed and built at the Whiteshell Nuclear Research Establishment specifically for process evaluations and development studies. Since its installation and commissioning early in 1985, four major campaigns have been performed with simulated HLLW solutions. In this paper, a brief description of the facility, along with the results obtained in one of the campaigns, are reported. The overall performance of the facility has been very good with no major operational problems. The performance of the Roto-Spray Calciner has been excellent, and it has operated for a cumulative time of more than 8000 hours. The performance of the Joule Melter has been equally good, except for some maintenance problems associated with the auxiliary heaters and components such as the solid feeders and off-gas lines. Being modular in design, the facility is amenable to testing flow sheet options and production of advanced waste forms at a future date with incorporation of alternative process modules.

30504 (CONF-860905–Vol.1, pp. 768-778) **Review of research and development of high level liquid waste vitrification in China.** Dong-hui, S. (Beijing Institute of Nuclear Engineering (China)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Since the operation of defense reprocessing plants, a considerable amount of high level liquid waste has been generated. These wastes are now stored in underground stainless steel tanks and will generally require to be immobilized by vitrification. Up to now the work focuses on the pot process, which utilized borosilicate glass as the waste form. Some results on vitrification factors such as glass formulation, pot materials, Ru behavior and removal, the denitration of HLLW, preparation of glass frit suspension have been obtained already. A cold pot facility in small scale has been operated. Due to the existence of sulfate in part of HLLW generated earlier, a yellow phase appears on the surface of molten glass during vitrification. Also, the waste loading in glass is limited to a certain extent. In order to increase the waste loading and to avoid the yellow phase appearance, the experimental investigation of the possibility of adding reducing agents has been conducted, and some good results were obtained. Because of the relatively limited capacity of the pot process, choosing a continuous process instead of pot process, such as AVM process developed by France and the joule-heated liquid-fed melter chosen by US, Japan and F.R.G., is under consideration.

30505 (CONF-860905–Vol.1, pp. 779-790) **High level waste management at the Idaho Chemical Processing Plant, Idaho National Engineering Laboratory.** Wheeler, B.R. (Westinghouse idaho Nuclear Co., Inc., Idaho Falls (USA)); Moffitt, W.C.; Mairson, R.C. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Idaho Chemical Processing Plant (ICPP) was the first and continues to be the only US facility to convert high level radioactive liquid waste into granular, calcined solids. These solids currently are placed in stainless steel bins for interim storage. The radioactive liquid wastes have resulted from the reprocessing of a wide variety of highly enriched, spent nuclear fuels including aluminum alloyed, zirconium alloyed, stainless steel alloyed and graphite matrix fuels. Because the fuels are alloyed, total dissolution is required in various acids depending on the fuel composition. The resulting acidic solutions containing all of the constitutents of the original fuel, plus the fission products, are processed through three cycles of solvent extraction to recover the uranium. All of the other constituents along with the acids end up in the waste tank farm and are ultimately calcined in the Waste Calcining Facility. Alternate strategies are being evaluated to immobilize the calcined waste and to provide for permanent disposal. The purpose of this paper is to describe the experience ICPP has had with operation of the New Waste Calcining Facility and to briefly identify the plan for possible immobilization of the solid calcine product to a form for suitable permanent disposal.

30506 (CONF-860905–Vol.1, pp. 791-797) **Mini-melter studies of high level nuclear waste form development: effects of added nitrates, carbonates and nitrates/formates in the slurry feed.** Finger, S.M. (Catholic Univ. of America, Washington, DC (USA)); Mohr, R.K.; Freeborn, W.P.; Pruss, F.; Jojaji, H.; Montrose, C.J.; Macedo, P.B. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

This research supports the plans of West Valley Nuclear Services, Inc. to stabilize their nuclear waste. The Vitreous State Laboratory (VSL) is performing studies to measure chemical durability for a range of possible production glass compositions, providing insight into both their durabilities and processing rates. A key element of this study is the use of the CUA-VSL slurry-fed mini-melter system to dynamically model and study alternative process conditions. This paper reports the results of investigations into the effects of added nitrates, carbonates and nitrates + formates in the slurry feed. Two base feed mixtures were used in these experiments: (1) AFF sludge + frit or glass formers, ion exchange media and chemical additives; and (2) Noah Chemical hydroxide feed with and without additives. The AFF sludge, with nitrate or carbonates additives, was susceptible to foaming, which was controllable by lowering the processing rate. The nitrate feeds could be processed at a maximum rate of 15-18 ml feed/min without significant foaming, and the carbonate feeds at 24-26 ml feed/min, which rates are significantly lower than the 25-35 ml feed/min rate for the base feed. The hydroxide feed could be melted at a rate of 25 ml feed/min. Adding nitrates caused foaming, limiting the feed rate to about 14 ml/min. Adding formate to the nitrated feed to compensate partially for the oxidizing effects of the nitrate exacerbated the foaming problem. The maximum sustainable feed rate for this feed was only 11 ml/min. No long-lasting scums, insoluble secondary phases or other deleterious surface phenomena were observed during any of the experimental runs.

30507 (CONF-860905–Vol.1, pp. 798-804) **Design and testing of the Defense Waste Processing Facility melter drain valve.** Edwards, R. Jr. (E. I. du Pont de Nemours and Co., Aiken, SC (USA)); Glascock, J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Defense Waste Processing Facility (DWPF) at the Savannah River Plant will use a joule-heated glass melter to process high-level radioactive defense waste into a borosilicate glass waste form. A prototype of a valve to drain the remaining glass from the melter at the end of its useful life is being tested at the Equipment Test Facility of the Savannah River Laboratory. The objective is to demonstrate the mechanical functionality of the valve and to uncover and solve problems related to its operation in the DWPF.

30508 (CONF-860905–Vol.1, pp. 805-832) **Steam explosions in slurry fed ceramic melters.** Hutcherson, M.N. (Fauske and Associates, Inc., Burr Ridge, IL (USA)); Ellison, P.G.; Fauske, H.K.; Henry, R.E.; Pellarin, D.J.; Chapman, C.C.; Kuhn, W.L. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high

level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The potential and consequences of a steam explosion in Slurry Fed Ceramic Melters (SFCM) have been assessed. The principles that determine if an interaction is realistically probable within a SFCM are established. Also considered are the mitigating effects due to dissolved, non-condensable gas(es) and suspended solids within the slurry feed, radiation, high glass viscosity, and the existence of a cold cap. An assessment was performed of the maximum available water in film boiling on the melter pool. The maximum potential work, an estimate of the maximum realistic efficiency, and the criteria for determining the influence of an interaction on the structural integrity of the melter vessel were established. 34 references, 11 figures, 1 table.

30509 (CONF-860905–Vol.1, pp. 851-860) **Vitrification of sodium-rich high-level waste.** Wiese, H. (Deutsche Gesellschaft zuer Wiederaufarbeitung von Kernbrennstoffen (West Germany)); Hoehlein, G.; Weisenburger, S. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The construction of the PAMELA vitrification plant at the EUROCHEMIC site in Mol/Belgium was completed in late 1984. After one year of cold test campaigns with simulated waste solution, the plant was put into radioactive operation in October 1985. This paper gives a detailed process description and results from four hot operation runs.

30510 (CONF-860905–Vol.1, pp. 861-870) **Long term leach behavior of West Valley HLW glasses.** Macedo, P.B. (Catholic Univ. of America, Washington, DC (USA)); Adiga, R.; Barkatt, A.; Freeborn, W.P.; Mohr, R.K.; Montrose, C.J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The leach behavior of the West Valley reference borosilicate glass and glasses of closely related compositions have been studied using several different leach tests. These include modified IAEA short-contact-time tests, MCC-1 static tests, modified MCC-3 static powder tests and partial-exchange pulsed-flow tests. From the data one can conclude that the resistance of the glasses to attack by aqueous media depends upon whether the glass develops a protective surface layer that prevents continued dissolution of the glass as the production and precipitation of silicate crystals from the leachant (the so-called hydrothermal effect) keep it from becoming saturated with respect to the glass. The results indicate that only in a relatively small composition "island" is the rate of layer generation suitable to balance the pH rise in the leachant so that a stable protective barrier is formed.

30511 (CONF-860905–Vol.1, pp. 871-882) **Characterization and comparison of highly radioactive and simulated glass and glass ceramic waste forms.** Malow, G. (Hahn-Meitner-Institut Berlin (West Germany)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Three European HLW glass and glass ceramic waste forms were investigated. The first part of the paper presents findings and discussions of fully radioactive waste forms. A technique was developed to prepare radioactive samples small enough to be removed from the hot cell for scanning electron microscopy and electron microprobe analysis (SEM and EPMA) investigations without additional shielding. The corrosion of the glasses was measured at different temperatures and in various leachants. In the second part the process of chemical corrosion of a simulated borosilicate waste glass is discussed based on particular processes such as build up of an alteration layer and phase formation on the glass surface and saturation of some elements in solution. 13 references, 9 figures, 4 tables.

30512 (CONF-860905–Vol.1, pp. 883-895) **Solubility interpretation of leach tests.** Mendel, J.E. (Pacific Northwest Lab., Richland, WA (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The phenomenological behavior of commercial silicate glasses and nuclear borosilicate glasses in confined glass: aqueous solution systems is similar. For commercial silicate glasses the behavior has been described, "If the neutral solution is unbuffered and confined in a bottle, it becomes alkaline and attack is accelerated, but eventually the accumulated products inhibit further action. Similar behavior is observed for nuclear waste borosilicate waste glasses in the MCC-1 Static Leach Test Method, the pulsed-flow test, and other leach tests in which the amount of solution in contact with the glass is restricted. In these tests the concentration of ions in the leachate increases initially (but not congruently, that is, the ratio of ion concentrations in the leachate is different than in the original glass), however, the concentration of each ion tends gradually towards its own steady-state concentration. The accumulated products that inhibit further action, and result in the tendency toward steady-state leachate concentrations, are found in an altered layer on the surface of the leached glass and are generally considered to arise from solubility constraints. 21 references.

30513 (CONF-860905–Vol.1, pp. 896-908) **Savannah River waste glass performance.** Wicks, G.G. (E. I. du Pont de Nemours and Co., Aiken, SC (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A multi-phase experimental program has been in progress at Savannah River for almost ten years to assess and explain the behavior of glass containing nuclear waste during solidification, transportation, and burial. Borosilicate glass wasteforms have performed superbly under the many conditions studied to date. 23 references, 5 figures, 5 tables.

30514 (CONF-860905–Vol.1, pp. 833-850) **In situ vitrification - a status of the technology.** FitzPatrick, V.F. (Pacific Northwest Lab., Richland, WA (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The In Situ Vitrification (ISV) process is a new technology developed from its conceptual phase to selected field-scale applications in the last 5 years. The US Department of Energy (DOE) has sponsored the ISV program to develop alternative technology for potential application to contaminated soil sites. The ISV process converts contaminated soils and wastes into a durable glass and crystalline waste form in place by melting using joule heating. The ISV process has been developed through a series of 25 engineering-scale (laboratory) tests, 10 pilot-scale (small field) tests, and four large-scale (full-scale field) tests. Its major advantages for stabilizing radioactive and hazardous wastes are found to be: safety

in terms of minimizing worker and public exposure; long-term durability of waste form (more than 1 million years); cost effectively ($150 to $300/m^3; applicability to a wide variety of soils and inclusions; and potential for eliminating exhumation, transport, and handling.

30515 (CONF-860905–Vol.1, pp. 909-923) **Characterization of a borosilicate glass incorporating MTR HLW with reference to the underground disposal.** Cantale, C. (ENEA, Rome (Italy)); Donato, A.; Guidi, G.; Fu, Z.J. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A borosilicate glass named BEL-15 for the immobilization of liquid HLW stored in Italy, produced by reprocessing of MTR fuels, has been studied from the point of view of a disposal in clay formations. Samples of this glass have been contacted with simulated clay interstitial water according to the MCC-1 test methods. The leachates have been analyzed by the ICP technique, while the leached sample surfaces have been examined using the SEM and EDAX techniques. The glass surface shows the presence of crystals of two types, different both from the point of view of the morphology and of the chemical composition. The activation energy of the glass corrosion reaction has been evaluated.

30516 (CONF-860905–Vol.1, pp. 924-934) **Development of a ceramic-based waste form to immobilize ICPP HLW.** Baker, R.S. (Westinghouse Idaho Nuclear Co., Idaho Falls (USA)); Staples, B.A.; Wood, H.C. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

A potential product for reducing high-level waste volume for final disposal is a ceramic-based waste form which has high waste loading and high density. Candidate ceramic-based waste formulations are being developed by varying the constituents of waste loading and oxides of boron, silicon, sodium and lithium using statistical and self-directing optimization techniques to result in a minimal volume of immobilized waste. The products resulting from this systematic variation are being compared on the basis of desirability coefficients derived from waste loading and product durability. 12 references, 4 figures, 10 tables.

30517 (CONF-860905–Vol.1, pp. 942-951) **Physical modeling test of joule heated ceramic melter system for high level waste vitrification.** Asano, H. (Ishikawajim-Harima Heavy Industries Co., Ltd., Tokyo, (Japan)); Morioka, M.; Sugarwara, T.; Yamaguchi, H.; Murakoshi, T.; Sakai, A. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

In order to avoid the effects of noble metal precipitation in the joule-heated ceramic-lined melter, the melter should be so designed that it has the sloped floor with the bottom sump. It is important to confirm the geometric configuration of the melting cavity and electrode arrangement on melter designing. Therefore, the authors have performed physical modeling tests of three-electrode melter systems, and have developed a thermal and fluid flow analysis code to confirm the experimental results. From the results of the physical modeling test, the effect of bottom slope angle is discussed, and the analytical results are verified by experimental results.

30518 (CONF-860905–Vol.1, pp. 952-960) **Startup sequence of the DWPF scale glass melter.** Weisman, A.F. (Savannah River Lab., Aiken, SC (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Du Pont Company is building a facility at the Savannah River Plant to immobilize high level radioactive waste within a borosilicate glass matrix. The process, known as the Defense Waste Processing Facility (DWPF), is scheduled to begin operation in 1989. The design and operation of the DWPF Glass Melter will be demonstrated during testing of a 2/3 linear scale melter. This paper reviews the startup phase of the Scale Glass Melter, completed in February 1986, which is representative of the planned DWPF melter startup.

30519 (CONF-860905–Vol.1, pp. 961-971) **Electrode corrosion and ruthenium behavior in a small joule ceramic melter.** Morris, J.B. (AERE Harwell, (England)); Dalton, J.T.; Evans, J.P.; Hollinrake, A.; Horsley, G.; Paige, E.L.; Sutcliffe, P.W.; Walmsley, D. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

After early work at PNL in the USA, the Joule-heated Ceramic Melter (JCM) is now the preferred tool for vitrifying high level (HLW) in the USA, Germany (FRG) and Japan. Harwell began to take an interest in the JCM system in the late 1970s with a desk study of some design concepts. The JCM was initially regarded as a second generation process which might be needed to replace the Windscale vitrification plant, now under construction at Sellafield, when it becomes obsolete. More recently the orientation of Harwell's JCM program has been changed to support an evaluation of the JCM process as a possible option for vitrifying fast reactor HLW arising at Dounreay. A large melter, the full-scale JCM, with a 0.6m x 0.6m cavity, was delivered to Harwell in 1982. However, owing to funding limitations this melter has not yet been completely installed. A smaller melter, with a 0.2m x 0.2m cavity and hence known as the one-third-scale JCM, was designed, constructed and operated at Harwell for about 10 months during 1983/84. It was then shut down and dismantled. This paper describes the design and operation of this one-third-scale JCM and then discusses the excessive corrosion found on the two electrodes.

30520 (CONF-860905–Vol.1, pp. 972-984) **Model predictions of glass fracturing in canisters during decontamination.** Farnsworth, R.K. (Pacific Northwest Lab., Richland, WA (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The decontamination of high-level waste canisters typically involves wet operations that induce a series of thermal transients in the glass product. If excessive, these transients can affect glass quality by increasing fracture. An examination of these transients was made by numerically modeling the transient thermal history of the glass in a typical canister cooling and decontamination cycle. Process variables examined in the modeling effort included glass decay heat, canister diameter, decontamination bath temperature, and the use of insulative liners. Results were evaluated to determine the parameters required for minimum impact on glass quality. The results show that insulative liners inside canisters are an effective means of reducing glass fracture during canister cooling and decontamination. Results also show a need for higher quench temperatures with any decrease in canister surface emissivity that may accompany decontamination. Processing options that could minimize this effect are discussed.

30521 (CONF-860905–Vol.1, pp. 985-991) **Glass melter feed system for vitrification of radioactive waste.** Crow, K.R. (Savannah River Lab., Aiken, SC (USA)). American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear

Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Defense Waste Processing Facility (DWPF) will incorporate radioactive waste at the Savannah River Plant into a borosilicate glass for disposal in a Federal repository. Vitrification is accomplished by combining treated waste with glass frit and feeding the slurry to a joule-heated melter. Two identical feed delivery systems pump slurry with high solids content and varying rheology to the melter at a combined rate of 3.3 liters per minute. All components in the feed system are designed to function in a high radiation environment and are remotely replaceable. Development and demonstration of the DWPF melter feed system are described.

30522 (CONF-860905--Vol.1, pp. 935-941) **Effects of composition on the leach behavior of West Valley HLW glasses.** Feng, X. (Catholic Univ. of America, Washington, DC (USA)); Adiga, R.; Barkatt, A.; Freeborn, H.P.; Macedo, P.B.; Mohn, R.K.; Montrose, C.J.; Moward, R.; Saad, E. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The durability of glasses with compositions near that of the West Valley reference glass composition (WV-205) have been characterized using both 7- and 28-day static powder leach tests. In addition the viscosities of these glasses have been measured over the temperature range 950°C to 1150°C to determine their suitability for processing. Both radioactive (containing U and Th) and nonradioactive glasses (with Al and Zr as surrogates) have been tested. For the narrow composition range studied it is found that as long as the pH of the leachate is nearly constant, the durability, as characterized by the concentration of boron in solution, can be regarded as a function only of the differences in the content of Si, Al and Zr relative to the reference glass; indeed it is possible to define a single reduced composition variable that apparently governs the durability of the glass. The form of this variable indicates that varying the Al_2O_3 content is twice as effective as SiO_2 on a weight basis in changing the durability of the glass.

30523 (CONF-890207--31) **Modeling the design and operations of the federal radioactive waste management system.** Joy, D.S.; Nehls, J.W. Jr.; Harrison, I.G.; Miller, C.; Vogel, L.W.; Martin, J.D.; Capone, R.L.; Dougherty, L. Oak Ridge National Lab., TN (USA). Apr 1989. 11p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From Waste management '89; Tucson, Arizona, USA; 26 Feb - 2 mar 1989. Order Number DE89012511/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Many configuration, transportation and operating alternatives are available to the Office of Civilian Radioactive Waste Management (OCRWM) in the design and operation of the Federal Radioactive Waste Management System (FWMS). Each alternative has different potential impacts on system throughput, efficiency and the thermal and radiological characteristics of the waste to be shipped, stored and emplaced. A need therefore exists for a quantitative means of assessing the ramifications of alternative system designs and operating strategies. We developed the Systems integration Operations/ Logistics Model (SOLMOD). That model is used to replicate a user-specified system configuration and simulate the operation of that system – from waste pickup at reactors to emplacement in a repository – under a variety of operating strategies. The model can thus be used to assess system performance with or without Monitored Retrievable Storage (MRS), with or without consolidation at the repository, with varying shipping cask availability and so forth. This simulation capability is also intended to provide a tool for examining the impact of facility and equipment capacity and redundancy on overall waste processing capacity and system performance. SOLMOD can measure the impacts on system performance of certain operating contingencies. It can be used to test effects on transportation and waste pickup schedules resulting from a shutdown of one or more hot cells in the waste handling building at the repository or MRS. Simulation can also be used to study operating procedures and rules such as fuel pickup schedules, general freight vs. dedicated freight. 3 refs., 2 figs., 2 tabs.

30524 (CONF-890488--8) **Gas generation from the irradiation of mortar.** Lewis, M.A.; Warren, D.W. Argonne National Lab., IL (USA). 1989. 18p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From 4. international symposium on ceramics in nuclear waste management; Indianapolis, Indiana, USA; 23-27 Apr 1989. Order Number DE89013280/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A mortar formulation capable of immobilizing chloride salts with high levels of radioactivity is being developed. As part of the developmental effort, radiation effects are being investigated. The radiolytic generation of gas(es) from irradiated mortar formulations was determined for several formulations with variable salt loadings at several test temperatures. The irradiation of a mortar formulation consisting of cement, slag, fly ash, water and 0 to 10 wt % salt led to the generation of hydrogen. The rate of generation was approximately constant, steady state pressures were not attained and final pressures were comparatively high. Higher salt concentrations were correlated with higher hydrogen generation rates for experiments at ambient temperature while lower rates were observed at 120°C. The irradiation of a mortar consisting of cement, fly ash, water and salt led to the radiolytic generation of both oxygen and hydrogen. The addition of 2 wt % FeS or CaS inhibited oxygen generation and changed the hydrogen production rate. 10 refs., 4 figs., 3 tabs.

30525 (CONF-890631--18) **A cask maintenance facility feasibility study.** Rennich, M.J.; Medley, L.G.; Attaway, C.R. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From International symposium on packaging and transporting of radioactive materials; Washington, D.C., USA; 11-16 Jun 1989. Order Number DE89012506/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Oak Ridge National Laboratory (ORNL) is developing a transportation system for spent nuclear fuel (SNF) and defense high level waste (HLW) as a part of the Federal Waste Management System (FWMS). In early 1988, a feasibility study was undertaken to design a stand-alone, "green field" facility for maintaining the FWMS casks. The feasibility study provided an initial layout facility design, an estimate of the construction cost, and an acquisition schedule for a Cask Maintenance Facility (CMF). The study also helped to define the interfaces between the transportation system and the waste generators, the repository, and a Monitored Retrievable Storage (MRS) facility. The data, design, and estimated costs resulting from the study have been organized for use in the total transportation system decision-making process. Most importantly, the feasibility study also provides a foundation for continuing design and planning efforts. Fleet servicing facility studies, operational studies from current cask system operators, a definition of the CMF system requirements, and the experience of others in the radioactive waste transportation field were used as a basis for the feasibility study. In addition, several cask handling facilities were visited to observe and discuss cask operations to establish the functions and methods of cask maintenance expected to be used in the facility. Finally, a peer review meeting was held at Oak Ridge, Tennessee in August, 1988, in which the assumptions, design, layout, and functions of the CMF were significantly refined. Attendees included representatives from industry, the repository and transportation operations.

30526 (DOE/EH--0088) **Technical safety appraisal of the Hanford Tank Farm Facility.** Brinkerhoff, L.C. USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). May 1989. 216p. Sponsored by DOE Environment Health & Safety. Order Number DE89012243/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report presents the results of one in a series of TSAs being conducted at DOE nuclear operations by the Assistant Secretary for Environment, Safety, and Health, Office of Safety Appraisals. TSAs are one of the initiatives announced by the Secretary of Energy on

September 18, 1985, to enhance the DOE environment, safety and health program. This report provides the results of a TSA of the Tank Farm in the 200 East and 200 West Areas located on the Hanford site. The appraisal was conducted by a team of experts assembled by the DOE Office of Safety Appraisals and was conducted during onsite visits of March 20–24 and April 3–14, 1989. At the Tank Farm, the processing of spent reactor fuels to recover the useful radioactive products is accompanied by the production of radioactive waste. Because many of these wastes will retain radioactivity for many years, they must be safely handled, contained, and disposed with regard to protection of the environment, employees, and the public. Dilute low-level waste and five year "cooled" aging wastes are pumped to an evaporator for concentration. The radioactive liquid and solid wastes are stored in underground carbon steel tanks ranging in capacity from 55,000 to over one million gallons.

30527 (DOE/NV/10322–25) **NNWSI [Nevada Nuclear Waste Storage Investigations] 51 seismic hole histories.** Fenix and Scisson, Inc., Tulsa, OK (USA). Sep 1987. 214p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC08-84NV10322. Order Number DE89013205/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report is a compilation of data from fifty-one shallow boreholes drilled within the Nevada Test Site (NTS) and the adjacent Bureau of Land Management (BLM) lands. The boreholes were drilled to determine the alluvial thickness and subsurface structure. Once drilled the boreholes were used to emplace explosive charges of three seismic refraction surveys conducted in 1981, 1983 and 1984. The information presented in this report includes location maps, daily activities and reviews of hole condition.

30528 (DOE/NV/10461–T1-Vol.1) **Environmental program planning for the proposed high-level nuclear waste repository at Yucca Mountain, Nevada: Volume 1.** Nevada Nuclear Waste Project Office, Carson City, NV (USA). Aug 1987. 135p. Sponsored by DOE Defense Programs. DOE Contract FG08-85NV10461. (NWPO-TR–001-87). Order Number DE89012958/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Environmental protection during the course of siting and constructing a repository is mandated by NWPA in conjunction with various phases of repository siting and development. However, DOE has issued no comprehensive, integrated plan for environmental protection. Consequently, it is unclear how DOE will accomplish environmental assessment, monitoring, impact mitigation, and site reclamation. DOE should, therefore, defer further implementation of its current characterization program until a comprehensive environmental protection plan is available. To fulfill its oversight responsibilities the State of Nevada has proposed a comprehensive environmental program for the Yucca Mountain site that includes immediately undertaking studies to establish a 12-month baseline of environmental information at the site; adopting the DOE Site Characterization Plan (SCP) and the engineering design plans it will contain as the basis for defining the impact potential of site characterization activities; using the environmental baseline and the SCP to evaluate the efficacy of the preliminary impact analyses reported by DOE in the EA; using the SCP as the basis for discussions with federal, state, and local regulatory authorities to decide which environmental requirements apply and how they can be complied with; using the SCP, the EA impact review, and the compliance requirements to determine the scope of reclamation measures needed; and developing environmental monitoring and impact mitigation plans based on the EA impact review, compliance requirements, and anticipated reclamation needs.

30529 (DOE/OSTI–3406-Suppl.1-Add.2) **Yucca Mountain Project bibliography, July–December 1988: An update: Civilian Radioactive Waste Management Program.** Tamura, A.T.; Lorenz, J.J. (comps.). USDOE Office of Scientific and Technical Information, Oak Ridge, TN (USA). Apr 1989. 43p. Sponsored by DOE Radioactive Waste Management. Order Number DE89005394/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This update contains information on the Yucca Mountain Project that was added to the Energy Data Base during the last six months of 1988. The update also includes a new section which provides information about publications on the Energy Data Base that were not sponsored by the project but have some relevance to it. This section covers the period 1977 to 1988. Prior to August 5, 1988, this project was called the Nevada Nuclear Waste Storage Investigations. The update is categorized by principal project participating organizations, and items are arranged in chronological order. Participant-sponsored subcontractor reports, meeting papers, and journal articles are included with sponsoring organization. Previous information on this project can be found in the Nevada Nuclear Waste Storage Investigations bibliographies: DOE/TIC-3406, which covers the years 1977 to 1985; DOE/OSTI-3406(Suppl.1), which covers 1986 and 1987; and the Yucca Mountain Project Bibliography, DOE/OSTI-3406(Suppl.1)(Add. 1), which covers the first six months of 1988. All entries in these publications are searchable online on the NNW data base file which can be accessed through the Integrated Technical Information System (ITIS) of the US Department of Energy (DOE).

30530 (DOE/RL–88-30-Vol.1) **Hanford site waste management units report: Volume 1.** Westinghouse Hanford Co., Richland, WA (USA). May 1989. 502p. Sponsored by DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE89013037/JAW. Available from NTIS, PC A22/MF A01 - OSTI; GPO Dep.

This Hanford Site Waste Management Units Report (HSWMUR) has been developed to provide information responsive to Section 3004(u) of the Hazardous and Solid Waste Amendments (HSWA) of 1984 United States (USC). The report provides a comprehensive Hanford Site inventory of all types of waste management units and consists of waste disposal units (including RCRA disposal units), unplanned releases (including those resulting from spills), in active contaminated structures, RCRA treatment and storage units, and other storage areas. Due to the comprehensive nature of this report, the listing of sites is more expansive than required by Section 3004(u) of HSWA. Appendix A provides the criteria used in the development of the HSWMUR. Appendix B contains definitions and acronyms used in this report. This report will be updated annually in January.

30531 (DOE/RL–88-30-Vol.2) **Hanford site waste management units report: Volume 2.** Westinghouse Hanford Co., Richland, WA (USA). May 1989. 481p. Sponsored by DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE89013038/JAW. Available from NTIS, PC A21/MF A01 - OSTI; GPO Dep.

This Hanford Site Waste Management Units Report (HSWMUR) has been developed to provide information responsive to Section 3004(u) of the Hazardous and Solid Waste Amendments (HSWA) of 1984 United States Code (USC). The report provides a comprehensive Hanford Site inventory of all types of waste management units and consists of waste disposal units (including RCRA disposal units), unplanned releases (including those resulting from spills), inactive contaminated structures, RCRA treatment and storage units, and other storage areas. Due to the comprehensive nature of this report, the listing of sites is more expansive than required by Section 3004 (u) of HSWA. Appendix A provides the criteria used in the development of the HSWMUR. Appendix B contains definitions and acronyms used in this report. This report will be updated annually in January.

30532 (DOE-RW–88.100) **Inorganic anion exchangers for the treatment of radioactive wastes.** Dyer, A.; Jamil, M.A. Department of the Environment, London (UK). Jul 1987. 251p. Order Number DE89614653/JAW. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Inorganic anion exchangers are evaluated for Tc, I and S isotope removal from aqueous nuclear waste streams. Chemical, thermal, and radiation stabilities were examined. Selected exchangers were examined in detail for their selectivities, kinetics and mechanism of the sorption process (especially in NO/sub 3//sup -/, OH/sup -/and BO/sub 3//sup -/environments). Cement encapsulation and leaching experiments were made on the exchangers showing most promise for 'radwaste' treatment.

30533 (DOE-RW–88.106) **Organic resin anion exchangers for the treatment of radioactive wastes.** Dyer, A.; McGinnes, D.F.

Department of the Environment, London (UK). Jul 1988. 248p. Order Number DE89614654/JAW. Available from NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS.

Organic anion exchange resins are evaluated for 99-TcO/sub 4// sup -/(pertechnate) removed from aqueous nuclear waste streams. Chemical, thermal and radiation stabilities were studied. Selected resins were examined in detail for their selectivities in the presence of I/sup -/, NO/sub 3//sup -/, SO/sub 4//sup =/, CO/sub 3//sup =/, Cl/ sup -/and OH/sup -/. Ion exchange equilibria and kinetic mechanisms were determined. Preliminary investigations of cement encapsulation in polymer modified form were made and some leach studies carried out.

30534 (DOE-RW–89.023) **Use of non-dimensional representation of the solute transport equations.** Laurens, J.-M. Department of the Environment, London (UK). Jul 1988. 59p. (EWE–2618.028). Order Number DE89617423/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

This report presents the results obtained in a pilot investigation into the use of non-dimensional representations of the solute transport equations, so as to improve the efficiency of the PRA codes used by the DoE and its contractors. A reduced set of parameters was obtained for a single layer transport model. As expected, the response was shown to be highly sensitive on the new parameters. A faster convergence of the system was observed when the sampling technique used was changed to take into account the properties of the new parameters, such that uniform coverage of the reduced parameter hyperspace was achieved.

30535 (DOE/RW–0233) **Office Automation Plan.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA). May 1989. 35p. Sponsored by DOE Radioactive Waste Management. Available from OSTI.

The Office of Civilian Radioactive Waste Management (OCRWM) Office Automation Plan (OAP) is intended to serve as a guide for establishing a comprehensive and integrated office automation environment at OCRWM Headquarters (OCRWM-HQ). The OAP will chart a course from the existing office automation environment to a new environment that will employ local and wide area networking technologies to enhance and extend the functionality of existing information resources at OCRWM-HQ. The major impetus for improving office automation at OCRWM-HQ is to provide procedures and technology for information collection and storage to support the requirements of the Licensing Support System (LSS). The LSS is an automated information storage and retrieval system that will assist the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) in the licensing of a repository for the disposal of spent nuclear fuel and high-level radioactive waste. It will facilitate the document-discovery process by containing the relevant licensing information in an electronic data base accessible to all interested parties. Access to the LSS will be available to parties prior to the NRC's consideration of the Department's license application as well as during the hearing proceedings.

30536 (DP-MS–89-11) **Nuclear facility air lock design criteria.** Perry, R.E.; Scaggs, K.R.; Allen, B.M., Jr. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant. 1989. 23p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. (CONF-890609–1: ASHRAE annual meeting, Vancouver, Canada, 24-28 Jun 1989). Order Number DE89006760/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The primary function of air locks in nuclear process facilities is to control the spread of radioactive contamination. Proper architectural and ventilation design of air locks is essential for this effective contamination control; however, there are no industrial standards for air lock design despite its importance. To develop air lock design guidelines, tests, along with an extensive literature search, were conducted at the Savannah River Plant (SRP) in Aiken, South Carolina. Three different air lock design methods were evaluated, and it was found that the Combined Ventilation Air Method is the most effective. The literature search supported the tests, and design guidelines were developed that enhanced the process of contamination control. 5 refs., 10 figs.

30537 (DPST–87-474) **Cation resins for Cs and Sr removal in the F/H Effluent Treatment Facility.** Bibler, J.P. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. 8 Jun 1987. 16p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. Order Number DE89013480/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In November 1988, waste that is now sent to seepage basins at the Savannah River Plant (SRP) will be sent to the F/H Effluent Treatment Facility (F/H ETF) for removal of toxic and radioactive impurities, except tritium. The final step in the purification of this waste before it is dispensed to the environment will be cation exchange for the removal of cesium and strontium nuclides. Several macroporous cation exchangers having sulfonic acid functional groups have been studied and compared for their abilities to sorb cesium and strontium ions from simulated and actual waste. Recent experimental results have indicated that elution properties of these resins will also be important if flowsheet process parameters are to be maintained. This study describes a comparison of the elution behavior of two candidate resins, Epicor®CS-1 and Diaion® HPK-25, under flowsheet conditions of concentration, direction of flow, and flow rate.

30538 (DPST–87-636) **F/H Effluent Treatment Facility ECWPF pilot test.** Piper, D.G. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. 22 Sep 1987. 8p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. Order Number DE89013481/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report summarizes the results of tests that were performed on the ECWPF reverse osmosis (RO) unit in support of the F/H Effluent Treatment Facility (ETF). The objectives of the study were to: (1) confirm the results of single element RO testing which indicate the standard Filmtec SW30 membrane is susceptible to performance losses as a result of tributyl phosphate (TBP) fouling, and (2) determine if performance of the Filmtec SW30-HR high rejection membrane is comparable to that of the standard membrane. The study was also designed to test how the performance of the three-stage F/H ETF RO process would be affected by TBP fouling. 3 figs., 1 tab.

30539 (DPST–89-319) **Residence time distributions for ETF pH adjustment system.** Lee, L. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. 15 Mar 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. Order Number DE89013499/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Residence time distributions for the ETF pH adjustment system have been calculated. This information together with precipitation kinetics can be used to calculate the amount of precipitation that will take place in and after the pH adjustment system.

30540 (EGG-M–88480) **PREPP [Process Experimental Pilot Plant] rotary kiln plant performance overview.** Berglund, G.R.; Halford, V.E.; Stermer, D.L.; Cargo, C.H.; Gale, L.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 6p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-890521–9: 8. international conference on thermal destruction of hazardous, radioactive, infectious and mixed wastes, Knoxville, Tennessee, USA, 1-5 May 1989). Order Number DE89011160/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Process Experimental Pilot Plant (PREPP), operated by EG and G Idaho, Inc. for the Department of Energy, Idaho Operations Office, has been designed and constructed for the incineration of transuranically contaminated waste stored at the Idaho National engineering Laboratory. The facility is currently being tested to verify operability of components and systems and to develop information necessary for performing an air quality compliance trial burn. Modifications are also in progress to correct operational deficiencies and to enhance the safety of the plant. This paper summarizes some of the results of the last test series. 3 refs., 1 fig.

30541 (EPRI-NP–5933, pp. 4.3) **Impact of regulations on operation of a LLW burial site.** Martinez, E. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

LOW-LEVEL RADIOACTIVE WASTES/radioactive waste disposal; RADIOACTIVE WASTE DISPOSAL/regulations; REGULATIONS; SITE CHARACTERIZATION

30542 (EPRI-NP–5933, pp. 1.3-1.32) **Radioactive waste volume reduction program at Brunswick Nuclear Project.** Worley, G.L. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A recently implemented low-level radioactive waste volume reduction program at Carolina Power & Light (CP&L) Company's Brunswick Nuclear Project in Southport, North Carolina, has achieved reductions of greater than 50 percent for 1984 and 1985. The yearly volume and curie content of low-level radioactive waste shipped for disposal during commercial operation of both units illustrates this. The nuclear industry enjoyed inexpensive and abundant radioactive waste disposal at six disposal sites up until late 1979. Today, only three are in operation. Disposal costs have risen from $4 per cubic foot to a present $27 per cubic foot plus numerous special surcharges and taxes. Nevertheless, Brunswick management recognized the need to establish dedicated radioactive waste groups to improve processing and reduce disposal volumes. In 1980 a dedicated Operations group was established to improve liquid waste management and in 1982 a dedicated Radiation Control group was established to improve dry active waste management.

30543 (EPRI-NP–5933, pp. 10.1-10.33) **Steam generator chemical cleaning waste processing at Millstone Unit No. 2.** Koste, W.R. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper is an update of ongoing efforts to process the waste from the secondary side cleaning of the Millstone Unit No. 2 steam generators. It discusses the methods and problems encountered during the dewatering, volume reduction and solidification of the various waste streams generated during this chemical cleaning. Both the chemical cleaning and the waste processing are first-of-a-kind processes.

30544 (EPRI-NP–5933, pp. 11.1-11.27) **Results of comparison testing of the General Electric and Westinghouse-Hittman compactors.** Larson, M.M.; Aldrich, W.C. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Super-compaction appears to be an excellent method for volume reduction of dry active waste (DAW) generated at nuclear facilities. However, there is no single nuclear facility which generates enough DAW to keep a super compactor in full-time operation and therefore no single facility can totally justify the purchase of one. An exception might be a group of nuclear facilities in close proximity which might jointly share in the use of a super compactor. The Idaho National Engineering Laboratory (INEL) may also be an exception. EG&G Idaho has conducted a compactor testing program in support of potential compaction activities at the INEL. The capabilities of the Westinghouse-Hittman compactor and the General Electric compactor were tested and compared, and the findings are presented in this report.

30545 (EPRI-NP–5933, pp. 13.3-13.67) **Radionuclide correlations in low level waste.** Miller, A. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This project focuses on the following concerns: scaling factor update; generic scaling factor; and curie inventories. Regarding the use of the scaling factors, the intent is to gather the data and present proposed generic scaling factors. The NRC has said that it will not go along with industry-wide scaling factors. You must develop your own plant scaling factors based upon your own plant samples. If and when we can collect sufficient data to support generic scaling factors, we should go to the NRC and get relief in cases where the scaling factors are reliable.

30546 (EPRI-NP–5933, pp. 14.1-14.17) **Classification system for low level radioactive waste disposal technologies.** Robinson, P. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

It is the purpose of this document to relate the functions required of an LLW disposal facility to the functional features designed into a facility to accomplish the requirements and to provide a comprehensive classification system for the various LLW disposal technologies that is self-consistent, provides meaningful descriptions of disposal technologies, and can describe the LLW disposal technologies as they are traditionally known. The approach used to classify the various LLW disposal technologies is described, and a generic classification system is presented. The traditional LLW disposal technologies are related to the generic classification system.

30547 (EPRI-NP–5933, pp. 2.1-2.22) **Volume reduction program at Crystal River Unit #3.** Roberts, B. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A low-level radioactive waste volume reduction program has been implemented at Crystal River Unit 3. The data reflect a 30% decrease over 1983, an outage year, and more importantly a 24% decrease from 1982, a non-outage year. At present the average waste generation is 20% less per week than Refuel IV. Adherence to the volume reduction policy not only helps Crystal River-3 cope with ever increasing disposal problems, but in turn decreases the contribution to the country's radioactive waste problem.

30548 (EPRI-NP–5933, pp. 3.3-3.17) **Iowa Electric's addition of a low level radwaste processing and storage facility to the Duane Arnold Energy Center.** Stigers, R.A. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

In early 1984, Iowa Electric Light and Power Company (IELP) hired an outside consultant to determine the most economically feasible storage alternative for use at the Duane Arnold Energy Center. It should be noted that concurrently with pursuit of the plans for a storage facility, IELP was developing the design of a radwaste processing building. This information was factored into the interim onsite storage study. The results of the study revealed that the most feasible concept was to integrate the design of the processing building with the storage facility. To avoid double-handling of radioactive waste and ensure that personnel exposure is ALARA, it was decided that the new Low Level Radwaste Processing and Storage Facility (LLRPSF) would be attached to the existing power block structure. In August 1985, design of the LLRPSF commenced with the preparation of a detailed construction specification and drawings. A contract was awarded to a local general contractor and construction of the facility began in April 1985 with the scheduled completion of the LLRPSF in the Spring of 1986.

30549 (EPRI-NP–5933, pp. 5.1-5.10) **Barnwell disposal site issues - 1985.** Lewis, M.S. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The year 1985 has been a year of anticipation concerning the future of low-level radioactive waste disposal, and a year of issues dealing with acceptable waste forms, classification, and compliance with disposal site criteria. How many people have wondered if they would have a place to dispose of their low-level radioactive waste in 1986? How many people have been more concerned with the proper method to dispose of their low-level radioactive waste? Issues dealing with the Low-Level Radioactive Waste Policy

Amendments Act of 1985, as well as, recent and future Barnwell site disposal method issues are to be discussed briefly. Most generators, in or out of the Southeast Compact region, will continue to dispose of low-level radioactive waste at the Barnwell Site through 1992 according to the Southeastern Compact legislation. Over the next seven years Barnwell Disposal Site license conditions, and disposal technology in general, will change to ensure the ultimate protection of the public's health and safety.

30550 (EPRI-NP–5933, pp. 8.1-8.40) **EPRI 1986 LLW program.** Robinson, P. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

An overview is presented of EPRI's low-level radioactive waste program. The key elements in the program include: minimization of waste generation; process technology assessment and development; assay methods advancement; solidification, packaging, and storage methods assessment; and technical guidance in LLW final disposal.

30551 (EPRI-NP–5933, pp. 9.1-9.9) **Radwaste evaporator operating experience at Callaway Nuclear Plant.** Ridgel, J.G. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper presents a study of the Radwaste evaporator operations during the first year of plant operations at Callaway Nuclear Plant. At Callaway all liquid borated wastes are processed by evaporation. The initial National Pollutant Discharge Elimination System (NPDES) permit issued to the plant limited our discharge of boron to 1 part per million (ppm). This would have necessitated deborating the discharge by ion exchange which proved cost prohibitive. Therefore, the decision was made to run the installed evaporators for boron removal. Callaway Plant has two borated liquid waste systems. The Boron Recycle System receives all Reactor Coolant System letdown and other clean wastes. The Liquid Radwaste System receives floor and equipment drains or dirty wastes. Processing of each waste stream will be discussed separately.

30552 (EUR–11187) **Study on sealing of boreholes.** (ENEA, Casaccia (IT). Centro Ricerche Energia. Commission of the European Communities, Luxembourg (Luxembourg). 1987. 106p. (In Italian). Available from NTIS (US Sales Only), PC A06/MF A01.

A bibliographical research on the problem of the backfilling and sealing of boreholes, shafts and tunnels for radioactive waste disposal has been carried out. Various materials - both natural and artificial - like clay, industrial cement, polymer concrete, geothermical and magnesium cement have been examined. Their main physico-chemical and durability characteristics have been examined. The problem of the interaction between the sealing and the geological environment has been also dealt. The final subject discussed in the bibliography is the damage caused to the host formation by the excavation of shafts and tunnels. The laboratory tests have been performed on a natural clay and other types of material (cement grout, cement grout with expansive additive, cement mortar and remoulded clay) which have been used as plug materials. The main conclusions obtained from the tests are the following: - The permeability of the cement is lower than the permeability of the clay; - no adhesion was observed between clay and cement mortar, with or without expansive additive, when cured under different ambient conditions, but without any application of load; - When curing took place under load, good adhesion was observed between the clay and the cement mortar; - The flow of water in a specimen consisting of a clay core surrounded by remoulded clay is larger than in the natural clay. These results seem to be caused by the different permeabilities of the remoulded and undisturbed clay and not to depend on flow at the contact between the two materials. A remote instrumentation package for the in situ evaluation of the performance of a plug, has been developed. In order to get rid of the uncertainty associated with the infiltration of the cables through the plug a wireless data transmission system, based on acoustic waves, has been developed.

30553 (EUR–11354-1) **Characterization of radioactive waste forms. Progress report for 1986 Volume 1.** Glasser, F.P.; McCulloch, C. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 149p. Available from NTIS (US Sales Only), PC A07/MF A01.

The Council of Ministers of the European Communities adopted the third five-year EC programme of research on radioactive waste management and disposal in March 1985. It was recognized that the inevitable production of radioactive waste required perfecting and demonstrating systems for managing the waste produced by the nuclear industry, ensuring at the various stages the best possible protection of man and the environment. Task 3 of the programme 'evaluation of conditioned waste and qualification of engineered barriers' is subdivided into five sections. This book, in two volumes, is a compilation of reports on the progress achieved in four of the sections during 1986, the first year of the third programme. Volume 1 is concerned with Sections 1 and 5, 'Research on low -and medium- active waste' and 'Quality control methods'. Volume 2 covers Section 2 'HLW form characterization' and Section 3 'Other engineered barriers'. Section 4 'Development of standard test methods' is not included in this edition, as results from an interlaboratory round robin test now in progress will only be available for inclusion for the year 1988.

30554 (EUR–11354-2) **Characterization of radioactive waste forms. Progress report for 1986 Volume 2.** Reed, D.L.; Mallinson, L.G. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 202p. Available from NTIS (US Sales Only), PC A10/MF A01.

The Council of Ministers of the European Communities adopted the third five-year EC programme of research on radioactive waste management and disposal in March 1985. It was recognized that the inevitable production of radioactive waste required perfecting and demonstrating systems for managing the waste produced by the nuclear industry, ensuring at the various stages the best possible protection of man and the environment. Task 3 of the programme 'evaluation of conditioned waste and qualification of engineered barriers' is subdivided into five sections. This book, in two volumes, is a compilation of reports on the progress achieved in four of the sections during 1986, the first year of the third programme. Volume 1 is concerned with Sections 1 and 5, 'Research on low-and medium- active waste' and 'Quality control methods'. Volume 2 covers Section 2 'HLW form characterization' and Section 3 'Other engineered barriers' Section 4 'Development of standard test methods' is not included in this edition, as results from an interlaboratory round robin test now in progress will only be available for inclusion for the year 1988.

30555 (EUR–11489-1) **Scale effect experiment in a fractured rock mass phase 2. Volume 1. Description of hydraulic tests carried out on the experimental site at Fanay-Augeres.** Durand, E. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 162p. (In French). Available from NTIS (US Sales Only), PC A08/MF A01.

An experimental and theoretical study dealing with 'scale effect' on hydraulic and transport parameters in a fractured rock mass was carried out in the granitic site at Fanay-Augeres. The study is divided into two phases. Phase 2A: experimental study and modelling of groundwater flows (respectively volume 1 and volume 2). Phase 2 B: experimental study and modelling of tracer tests (respectively volume 3 and volume 4); determination of the in-situ state of stress in the rock mass (volume 5). This study is part of the coordinated project MIRAGE (radionuclide migration in the geosphere), research subject matter number 4 hydrogeology.

30556 (EUR–11489-2) **Scale effect experiment in a fractured rock mass phase 2. Volume 2. Interpretation and modelling of the hydraulic tests carried out on the experimental site at Fanay-Augeres.** Cacas, M.C.; Ledoux, E.; Marsily, G. de; Tillie, B. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 133p. (In French). Available from NTIS (US Sales Only), PC A07/MF A01.

An experimental and theoretical study dealing with 'scale effect' on hydraulic and transport parameters in a fractured rock mass was carried out in the granitic site at Fanay-Augeres. The study is divided into two phases. Phase 2A: experimental study and modelling

of groundwater flows (respectively volume 1 and volume 2). Phase 2 B: experimental study and modelling of tracer tests (respectively volume 3 and volume 4); determination of the in-situ state of stress in the rock mass (volume 5). This study is part of the coordinated project MIRAGE (radionuclide migration in the geosphere), research subject matter number 4 hydrogeology.

30557 (EUR–11489-3) **Scale effect experiment in a fractured rock mass phase 2. Volume 3. Description of the tracer tests carried out on the experimental site at Fanay-Augeres.** Calmels, P.; Gaillard, B.; Margrita, R. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 163p. (In French). Available from NTIS (US Sales Only), PC A08/MF A01.

An experimental and theoretical study dealing with 'scale effect' on hydraulic and transport parameters in a fractured rock mass was carried out in the granitic site at Fanay-Augeres. The study is divided into two phases. Phase 2A: experimental study and modelling of groundwater flows (respectively volume 1 and volume 2). Phase 2 B: experimental study and modelling of tracer tests (respectively volume 3 and volume 4); determination of the in-situ state of stress in the rock mass (volume 5). This study is part of the coordinated project MIRAGE (radionuclide migration in the geosphere), research subject matter number 4 hydrogeology.

30558 (EUR–11489-4) **Scale effects experiment in a fractured rock mass phase 2. Volume 4. Interpretation and modelling of the tracer tests carried out on the experimental site at Fanay-Augeres.** Cacas, M.C., Ledoux, E.; Marsily, G. de. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 80p. (In French). Available from NTIS (US Sales Only), PC A05/MF A01.

An experimental and theoretical study dealing with 'scale effect' on hydraulic and transport parameters in a fractured rock mass was carried out in the granitic site at Fanay-Augeres. The study is divided into two phases. Phase 2A: experimental study and modelling of groundwater flows (respectively volume 1 and volume 2). Phase 2 B: experimental study and modelling of tracer tests (respectively volume 3 and volume 4); determination of the in-situ state of stress in the rock mass (volume 5). This study is part of the coordinated project MIRAGE (radionuclide migration in the geosphere), research subject matter number 4 hydrogeology.

30559 (EUR–11489-5) **Scale effect experiment in a fractured rock mass phase 2. Volume 5. Methodology and results of in-situ stress measurement carried out in the granitic rock mass at Fanay-Augeres.** Ouvry, J.F. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 126p. (In French). Available from NTIS (US Sales Only), PC A07/MF A01.

An experimental and theoretical study dealing with 'scale effect' on hydraulic and transport parameters in a fractured rock mass was carried out in the granitic site at Fanay-Augeres. The study is divided into two phases. Phase 2A: experimental study and modelling of groundwater flows (respectively volume 1 and volume 2). Phase 2 B: experimental study and modelling of tracer tests (respectively volume 3 and volume 4); determination of the in-situ state of stress in the rock mass (volume 5). This study is part of the coordinated project MIRAGE (radionuclide migration in the geosphere), research subject matter number 4 hydrogeology.

30560 (EUR–11611) **Optimization of waste management by actions taken at source.** Strachan, N.R.; Wakerley, M.W. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 111p. Available from NTIS (US Sales Only), PC A06/MF A01.

The purpose of this document is to collate and review information on those measures and practices adopted within nuclear facilities to optimize the management of radioactive waste at the point at which it arises. The information on which it has been based has been obtained by a review of the literature and by visits to a number of different types of facilities within the European Community. The search revealed mainly references to waste-management optimization at US LWRs, whereas the visits have tried to cover as wide a range of European facilities as practicable. There are a number of different respects in which radioactive waste can be minimized: - minimizing the amount of activity appearing in the wastes. This is best achieved by the design of process equipment; - minimizing the volume of waste with which radioactivity is associated. This is best achieved by a combination of administrative controls and equipment design; - minimizing the amount of material which for administrative or measurement reasons is considered to be radioactive. Many examples of minimization at source by means of developments in equipment and administrative controls that were encountered during our visits, or identified in the literature search, are described.

30561 (EUR–11627) **Long-term solute diffusion in a granite block immersed in sea water.** Jefferies, N.L. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 15p. Available from NTIS (US Sales Only), PC A03/MF A01.

Solute diffusion profiles for Cl/sup -/, Br/sup -/, F/sup -/and S0/sub 4//sup –/have been measured in a granite block which was immersed in the sea at Falmouth, Cornwall, for 30 years. Leachable concentrations of Cl/sup -/and Br/sup -/were found to be higher in the block than in quarry samples of granite, which demonstrates that solutes from the sea water have diffused into the block. The Cl/sup -/and Br/sup -/profiles within the block were flat, implying that equilibrium has been reached between the seawater and granite porewater. The apparent diffusion coefficient and the solute accessible porosity have been estimated from these profiles, and these were used to calculate the intrinsic diffusion coefficient which was then compared with previously obtained laboratory data. Concentration profiles for F/sup -/and S0/sub 4//sup –/indicate that these elements have high concentrations at the margins of the block (to depths of up to 15 cm) and are in the process of diffusing outwards into the surrounding seawater. The initially high porewater concentrations of F/sup -/and SO/sub 4//sup –/in the block are believed to result from weathering of the granite prior to its immersion in the sea, due to the breakdown of primary minerals such as pyrite and the micas. F/sup -/and SO/sub 4//sup - /- sorptivity has been estimated from an analysis of the porewater concentration profiles. This preliminary experiment has demonstrated the potential for the measurement of solute migration in granite, as a result of the rock having been immersed in seawater. This work is part of the CEC project MIRAGE (radionuclide migration in the geosphere)- Second phase (1985-89) Research area 'Natural analogues'.

30562 (HW–36819) **Iodine emission from separations processes and flowsheets for improved emission control.** Smith, R.E. General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation. 23 May 1955. 12p. Sponsored by DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE89013133/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Declassified 14 June 1989.

Silver reactors were installed at the $BiPO_4$ plants in 1950 and were included in the Redox and Purex designs. Prior emissions were of the order of 30 to 40 curies per day and the reactors were intended to achieve "reasonable" levels of less than 10 curies per day. At that time a level of 1 curie per day per plant appeared to be a reasonable goal and levels above this were investigated and reactors regenerated as necessary. Malperformance of reactors, short cooled feeds, and high capacities produced many high emission levels during early 1955. Based on studies of vegetation contamination Radiological Sciences suggested new goals which limited even further the tolerable emission level. These goals would limit emission to a maximum emission of 10 curies per week for all plants. The purposes of this document are three-fold: (1) to review the separations plants' iodine loads in the light of HAPO production goals and illustrate the effects of power level and metal cooling time on separations capacity under controlled amounts of iodine emission; (2) to review the past average performance of the Redox and T-Plant iodine retention efficiencies and show how their operation has greatly exceeded the initial criterion for iodine emission control; and (3) to present flowsheet schemes for additional iodine removal facilities at T-Plant, Redox, and Purex in order that new production and iodine emission goals may be met

30563 (INIS-GB–188) **Micro-organisms and nuclear waste: a neglected problem.** Arnott, Don. Universities Research Reactor, Risley (UK). [1989]. 8p. Order Number DE89614664/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI.

The paper addresses the problem of bacteria in nuclear waste disposal. A description is given of how bacteria colonised the Three Mile Island Nuclear Reactor soon after meltdown, demonstrating the

ability of some bacteria to operate under extreme conditions. Work is also described indicating that microbial corrosion of metal canisters can occur. Thus the author recommends that studies of nuclear waste disposal should take into account the interrelations between geology, geochemistry and microbiology. (U.K.).

30564 (INIS-mf–11422) **Location-independent study concerning the construction, operation and closure of possible facilities for the final storage of radioactive waste in rock-salt formations in the Netherlands. Executed by Van Hattum and Blankevoort asked for by the Netherlands Energy Research Foundation and subsidized by the Ministry of Economic Affairs.** Van Hattum en Blankevoort, Beverwijk (Netherlands); Netherlands Energy Research Foundation, Petten (Netherlands). Apr 1986. 421p. (In Dutch). Order Number DE89614665/JAW. Available from NTIS (US Sales Only), PC A18/MF A01 - OSTI; INIS.

Figs.; tabs.

Final storage of radioactive waste has been studied on the base of two main concepts: in deep boreholes and caverns from the mowing-field, and for a, for this purpose to be developed, underground ore. Storage supplies have been designed, including the closing constructions after finishing the storage activities, with a, much longer than usually, technical lifetime. Herein use has been made of in general known materials whose properties and behaviour were assumed to remain unaltered over long periods and also will not be influenced by the rock-salt environment. The possible storage concepts described are location independent and based upon the geological and geomechanical information which have been provided with the task and which are indicative for the rock-salt formations occurring in the Netherlands. In first instance the authors have started from the thermodynamical, chemical and fysical properties of the storage rock-formations as are mentioned in the apendices of the task. It particularly concerns properties of the storage rock-formations and the construction materials needed for a qualitatively good and reliable closing of the storage. The construction and operation of the in this report described storage concepts is based upon the storage scenario's as indicated in the task circumscriptions. Includes refs.

30565 (KFK–4521) **Model investigations for trace analysis of iodine, uranium, and technetium in saturated sodium chloride leaching solutions of stored radioactive waste.** Jegle, U. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie. Feb 1989. 190p. (In German). Order Number DE89774597/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

This paper describes the development of a time and cost saving chromatographic technique, which allows the matrix to be separated and the most important species to be analyzed in a leaching solution of vitrified radioactive waste. Uranium, iodine, and technetium were chosen for the model technique to be elaborated. In a first step, iodide and pertechnetate were separated from the matrix by the strongly basic AG 1X 8 anion exchange resin and then separated from each other by selective elution. The uranyl ions eluted with the sodium chloride matrix were separated from the excess of sodium chloride in a second step, again by adsorption to the strongly basic resin. The ion-selective electrode was found to be a suitable tool for iodide analysis. Pertechnetate was analysed by means of liquid scintillation. Uranium was determined by ICP-AES.

30566 (KFK–4529) **Gamma irradiation and in-situ corrosion studies on unalloyed steels for a high level waste packaging in a rock salt repository.** Smailos, E.; Schwarzkopf, W.; Koester, R.; Fiehn, B. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik. Mar 1989. 26p. Order Number DE89774750/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Previous corrosion studies on a number of materials have shown that unalloyed steels are promising materials for long-term resistant packagings to be used in disposal of heat-generating wastes in rock salt formations. In order to characterize in more detail their corrosion behaviour, further in-depth laboratory-scale and in-situ corrosion studies have been performed on two selected steels. In the laboratory-scale experiments the influence of gamma dose rates has been investigated, which are relevant to the thick-walled HLW packaging discussed in terms of the corrosion behaviour of fine-grained steel (reference steel) at 90/sup 0/C. The steel in the welded and unwelded conditions has been examined in the two-phase corrosion media rock salt/MgCl/sub 2/-rich brine and rock salt/NaCl-rich brine as may be present in certain accident scenarios in a repository. In the in-situ experiments conducted in the Asse salt mine the corrosion behaviour of cast steel has been investigated. The steel has been exposed to the combined influence of selected characteristics of container manufacturing (welding, geometry) and simulated accident conditions, accompanied by the intrusion of NaCl brine into the HLW boreholes. The testing temperatures of the cast steel tube used has been between 90/sup 0/C and 200/sup 0/C.

30567 (LBL–25769) **The effect of precipitation on contaminant dissolution and transport: Analytic solutions.** Light, W.B.; Chambre, P.L.; Pigford, T.H.; Lee, W.W.L. Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley, CA (USA). Dept. of Nuclear Engineering. Sep 1988. 17p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (UCB-NE–4127). Order Number DE89013367/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We analysed the effect of precipitation on the dissolution and transport rates of a nondecaying contaminant. Precipitation near the waste surface can have a profound effect on dissolution and transport rates. The mass-transfer rate at the waste surface is controlled by the solid-liquid reaction rate to an extent determined by the modified reaction-rate modulus, α. At later times extending to steady state, the mass-transfer rate depends on the location of the precipitation front r_p and on the solubility ratio C_o/C_p. A precipitation front very near the waste surface can change the dissolution mechanism from solubility-diffusion-controlled to chemical-reaction-rate controlled. Precipitation limits the concentration of the contaminant at $r > r_p$ to C_p, steepening the concentration gradient for dissolution on the waste package side of the front and flattening the gradient for transport in the region outside the front. This increases the rate of contaminant transport from the waste to the front while decreasing the rate of transport away from the front, when compared to the situation without precipitation. The difference in the transport rates at the front is the rate of precipitation. For large changes in solubility, most of the contaminant is immobilized by precipitation, as was observed in a parallel study. The effect of a precipitation front located nearby in surrounding rock is to increase the release rate at the waste surface/rock interface. The increase in release rate at the waste surface is greater the closer the precipitation and the larger the ratio C_o/C_p, also observed by others. The release rates of other waste constituents that dissolve congruently with the solubility-controlling matrix can be increased by a local high-solubility region between the waste surface and the precipitation front. 10 refs., 5 figs.

30568 (OEVS-Mitteilung–1988, pp. 429-433) **Criteria for choice of decontaminating agents for trouble-free processing of radioactive waste waters from the control area of nuclear power plants.** Henning, K. (Hakawerk, Waldenbuch (Germany, F.R.)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

For processing of waste waters produced in the control areas of nuclear power plants, evaporation, filtration and centrifugation are widely used. Radioactive concentrates from the processes are put into matrix materials e.g. cement or bitumen, or processed by roller frame drying and thus conditioned for intermediate- and final storage. For a trouble-free running of these equipments foaming behavior and thermal stability are important criteria. Decontaminating agents for surface-, device-, linen- and personnel agents are described, featuring sufficient thermal stability up to 300/sup 0/C and free of troubling foaming due to the use of primarily low-foam constituents. 1 fig., 2 tabs.

30569 (ORNL/CSD/TM–251) **Multicode comparison of selected source-term computer codes.** Hermann, O.W.; Parks,

C.V.; Renier, J.P.; Roddy, J.W.; Ashline, R.C.; Wilson, W.B.; LaBauve, R.J. Oak Ridge National Lab., TN (USA). Computing and Telecommunications Div. Apr 1989. 171p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. Order Number DE89012901/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report summarizes the results of a study to assess the predictive capabilities of three radionuclide inventory/depletion computer codes, ORIGEN2, ORIGEN-S, and CINDER-2. The task was accomplished through a series of comparisons of their output for several light-water reactor (LWR) models (i.e., verification). Of the five cases chosen, two modeled typical boiling-water reactors (BWR) at burnups of 27.5 and 40 GWd/MTU and two represented typical pressurized-water reactors (PWR) at burnups of 33 and 50 GWd/MTU. In the fifth case, identical input data were used for each of the codes to examine the results of decay only and to show differences in nuclear decay constants and decay heat rates. Comparisons were made for several different characteristics (mass, radioactivity, and decay heat rate) for 52 radionuclides and for nine decay periods ranging from 30 d to 10,000 years. Only fission products and actinides were considered. The results are presented in comparative-ratio tables for each of the characteristics, decay periods, and cases. A brief summary description of each of the codes has been included. Of the more than 21,000 individual comparisons made for the three codes (taken two at a time), nearly half (45%) agreed to within 1%, and an additional 17% fell within the range of 1 to 5%. Approximately 8% of the comparison results disagreed by more than 30%. However, relatively good agreement was obtained for most of the radionuclides that are expected to contribute the greatest impact to waste disposal. Even though some defects have been noted, each of the codes in the comparison appears to produce respectable results. 12 figs., 12 tabs.

30570 (ORNL/Sub–89-21242/1) **Tumulus Disposal Demonstration Project assessment plan for potential worker exposure: Revision 1.** Styers, D.R. Oak Ridge National Lab., TN (USA); Automated Sciences Group, Inc., Oak Ridge, TN (USA). Mar 1989. 72p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400;AC05-86OR21642. Order Number DE89012257/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The purpose of the "Assessment Plan for Potential Worker Exposure" is to determine the potential radiological exposures to the workers as they dispose of low-level radioactive wastes (LLW) on the Tumulus Disposal Demonstration Project (TDDP). An evaluation of the work procedures and precautions will be made so as to maintain the exposure levels As Low As Reasonably Achievable (ALARA). 10 refs., 10 figs.

30571 (ORNL/TM–10919) **Compendium of technical computer codes used in support of the DOE Office of Civilian Radioactive Waste Management.** McBride, A.F.; Austin, P.N.; Ward, W.M.; McCarn, L.B.; Roddy, J.W.; Ludwig, S.B.; Reich, W.J.; Roussin, R.W. Oak Ridge National Lab., TN (USA). Apr 1989. 330p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. Order Number DE89012906/JAW. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

A compilation of technical computer codes related to ongoing work under the cognizance of the US Department of Energy's Office of Civilian Radioactive Waste Management (DOE/OCRWM) is presented. Much of the information was obtained from responses to a questionnaire distributed by DOE/OCRWM to all DOE offices associated with the radioactive waste management program. The codes are arranged alphabetically by name. In addition to the code description, each sheet includes other data such as computer hardware and software requirements, document references, name of respondent, and code variants. The codes are categorized into seventeen subject areas plus a miscellaneous category. Some of the subject areas covered are atmospheric dispersion, biosphere transport, geochemistry, nuclear radiation transport, nuclide inventory, and risk assessment. Three appendixes are included which list the names of the contributors, a list of the literature reviewed, and a glossary of computer code terminology and definitions. 50 refs., 3 tabs.

30572 (PNL–6699) **Process simulation and statistical approaches for validating waste form qualification models.** Kuhn, W.L.; Toland, M.R.; Pulsipher, B.A. Pacific Northwest Lab., Richland, WA (USA). May 1989. 198p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE89013342/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report describes recent progress toward one of the principal objectives of the Nuclear Waste Treatment Program (NWTP) at the Pacific Northwest Laboratory (PNL): to establish relationships between vitrification process control and glass product quality. during testing of a vitrification system, it is important to show that departures affecting the product quality can be sufficiently detected through process measurements to prevent an unacceptable canister from being produced. Meeting this goal is a practical definition of a successful sampling, data analysis, and process control strategy. A simulation model has been developed and preliminarily tested by applying it to approximate operation of the West Valley Demonstration Project (WVDP) vitrification system at West Valley, New York. Multivariate statistical techniques have been identified and described that can be applied to analyze large sets of process measurements. Information on components, tanks, and time is then combined to create a single statistic through which all of the information can be used at once to determine whether the process has shifted away from a normal condition.

30573 (PNL–6884) **Leach testing of simulated Hanford Waste Vitrification Plant reference glass HW-39.** Bates, S.O.; Piepel, G.F.; Johnston, J.W. Pacific Northwest Lab., Richland, WA (USA). May 1989. 180p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. Order Number DE89012821/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report summarizes the work performed to investigate the viability of a leach testing methodology for the Hanford Waste Vitrification Plant (HWVP) and provide glass dissolution data for HWVP model determination and validation. Leach tests up to one year in duration were conducted on the HWVP reference glass HW-39-1 (1.3 wt % Cr_2O_3), using the Materials Characterization Center Static Leach Test (MCC-1) and the Agitated Powder Leach Test (MCC-3). Glass surface area to leachate volume (SA/V) ratios of 10, 530, 2000, and 20,000 m^{-1} were investigated during testing. The data resulting from the leach tests were statistically analyzed to evaluate the testing methodology. Based on these analyses, changes are recommended in the leach testing methodology, including changes in the randomization and replication plans to provide for better statistical characterization of glass durability. The statistical evaluation of the test data found that the current leach testing methodology provides the necessary data for calculating some of the sources of variability in the test results, but not others. Proposed additions and modifications to the testing methodology will provide for collecting the data required to estimate the other variance components so that defensible statistical qualification statements can be made. 17 refs., 15 figs., 5 tabs.

30574 (PTB-SE–7/2(rev.ed.)) **Dose rates of waste packagings. A manual for activity determination of single radionuclide mixtures in standardized waste packagings resulting from dose rate limits.** Ehrlich, D.; Theis, P.; Thomauske, B. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle. Aug 1988. 59p. (In German). Order Number DE89774748/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

A one-dimensional transport code was used for the container shielding calculations whereas for cylindrical waste packages, a Point-Kernel code was used. Nuclide-specific calculations aiming at the determination of the dose rate at distance of 1 m and 2 m from the waste package surface were carried out for five key nuclides (Cs-134, Cs-137, Co-60, Ru-106, Mn-54) per unit of activity. With the results given in the Annex in the form of tables and, in some cases, additionally as graphs, the value of the dose rate for any mixture of radionuclides in different waste packages can be calculated using suitable summation rules. The results can be made use of for the specification of an appropriate conditioning (immobilization and/or packaging) of primary waste of given radionuclide composition.

30575 (SAAS–369) **Advice on the disposal of radioactive by-products arising in the use of nuclear energy.** Beyermann, M.; Goergner, D. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 15p. (In

German). Order Number DE89617425/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Based on the current legislation in the GDR advice is given on the classification and disposal of radioactive by-products from the utilization of nuclear energy with special emphasis on the different procedures for products which require a disposal licence by the National Board for Atomic Safety and Radiation Protection and those which do not need such an authorization.

30576 (SAND–86-2357) **OGR [Office of Geologic Repositories] repository-specific rod consolidation study: Effect on costs, schedules, and operations at the Yucca Mountain repository.** O'Brien, P.D. Sandia National Labs., Albuquerque, NM (USA). Dec 1988. 123p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE89012947/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report compares repository life-cycle costs and assesses operational trade-offs for waste management scenarios with and without spent fuel rod consolidation. The study is specific to a geologic repository being considered for location in the tuff formations at Yucca Mountain, on and near the Nevada Test Site in southern Nevada. Four cases are considered. In Cases 1 and 2, intact spent fuel is received directly from the nuclear utilities; and in Cases 3 and 4, most of the fuel is received from a Monitored Retrievable Storage (MRS) facility. Case 1 features at-repository consolidation, whereas in Case 2 the fuel is packaged and emplaced as intact fuel assemblies. Case 3 assumes at-MRS consolidation, and Case 4 assumes no consolidation either at the MRS or at the repository. The total life-cycle cost for the Case 1 (reference) repository is about $6.6 billion (in 1986 dollars). In Case 2, "intact" disposal saves $0.5 billion and offers a number of operational advantages. The presence of an MRS in the waste management system reduces repository costs, with or without at-MRS consolidation. Life-cycle costs for Cases 3 and 4 are, respectively, $1.2 billion and $1.0 billion less than the Case 1 cost; thus, consolidation at the MRS reduces the repository cost by $0.2 billion. Operationally, the MRS is advantageous in that it eliminates–or, rather, transfers to the MRS–the most difficult and complex operations in the preparation of spent fuel for disposal. 9 refs., 27 figs., 15 tabs.

30577 (SAND–87-0754) **Low-Level Waste Ocean Disposal Program final report: Site characterization of the Pacific Study Area, West Coast, Northern Site (W-N).** Marietta, M.G.; Jackson, D.W. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 129p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89012926/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report describes the outcome of a Pacific Ocean research program begun in November 1978 by Sandia National Laboratories for the Bettis Atomic Power Laboratory. The six-year oceanographic program was in support of a US Navy environmental evaluation of possible sea disposal of defueled, decommissioned, nuclear-powered submarines. Evaluation guidelines were written to define a site suitable for such sea disposal. This final report, which combines results from two previous progress reports and data from recently completed studies, characterizes a suitable site, the West Coast, Northern Site (W-N). Although W-N is neither the only possible nor the best Pacific site, it is one suitable location under the site evaluation guidelines. 95 refs., 29 figs., 10 tabs.

30578 (SAND–88-1156) **A review of near field seawater-sediment interactions with application to the subseabed disposal of nuclear waste.** Krumhansl, J.L. Sandia National Labs., Albuquerque, NM (USA). 10 Mar 1989. 68p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE89012802/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Disposal of spent fuel or high level nuclear waste into marine sediments would create high temperature-high gamma radiation environments adjacent to waste canisters. Under these conditions sediments will react producing pore waters that differ significantly from those occurring naturally. These changes may enhance canister corrosion or facilitate transport of radionuclides through unreacted sediments beyond the heated zone. In addition, the term "near field" needs clarification as it is used widely without having a precise meaning. Research in three areas was undertaken to improve our understanding of near field chemical processes. Initially, isothermal experiments were carried out in "Dickson" hydrothermal systems. These were followed by an experimental program directed at understanding the chemical effects of temperature-gradient induced transport. Finally, additional experimentation was done to study the combined effects of hydrothermal conditions and intense gamma radiation. Having completed this body of experimental work, it was concluded that near field conditions are not an obstacle to the safe use of abyssal marine sediments for the disposal of spent fuel or high level nuclear wastes. 41 refs., 6 figs., 17 tabs.

30579 (SAND–88-2230C) **The delineation of the disturbed rock zone surrounding excavations in salt.** Borns, D.J.; Stormont, J.C. Sandia National Labs., Albuquerque, NM (USA). 1989. 8p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. (CONF-890628–8: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89007036/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

At the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico, the Disturbed Rock Zone (DRZ, the zone of rock in which the mechanical and hydrologic properties have changed in response to excavation) has been characterized with visual observations, geophysical methods, and gas-flow measurements. The visual observations, geophysics, and gas-flow tests have defined a DRZ at the WIPP extending laterally throughout the excavation and varying in depth from 1 to 5 m. Desaturation and microfracturing has occurred to some degree within the zone. The dilation that results from the microfracturing in the DRZ provides a component of the observed closure. 19 refs., 7 figs.

30580 (SAND–88-2342C) **Technical issues affecting the transport of dual purpose casks.** Sanders, T.L.; Ottinger, C.A.; Brimhall, J.L.; Gilbert, E.R.; Jones, R.H. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–1: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013585/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Approximately 60,000 metric tons of uranium (MTU) spent fuel will be discharged by the projected 2003 startup date of a federal disposal system. Of this, approximately 15,000 MTU will require storage outside existing or projected pool storage capabilities (Orvis et al., 1984). At-reactor dry storage of spent fuel, including vault, caisson, and cask systems, is being considered as an alternative to accommodate this excess fuel. Two dry storage cask concepts are among those under consideration. One involves placing spent fuel in storage-only casks (SOC) until a monitored retrievable storage (MRS) facility or repository is open, when the spent fuel would be transferred to a transport-only cask (TOC) for shipment. The second option, the dual purpose or transportable storage cask (TSC), is a system that would serve for both storage and later transport. To carry out its purpose, a TSC must be shipped directly from a storage facility to a disposal facility without first being opened to evaluate the cask or the fuel. To assure that both the fuel and the cask are in a transportable condition after 20 to 40 years of storage requires: (1) a definition of expected storage conditions; (2) an assessment of the impact of expected storage conditions on the reliability of the components and functions of the TSC during transport; and (3) the development of an overall TSC system design and operational strategy which ensures that TSC transport reliability compares to that of a transport-only cask. The later requirement is related to defining what appropriate design features, pre-shipment inspection, and/or alternative fuel and cask monitoring requirements are necessary during long-term storage to ensure the cask will meet transport performance requirements during later transport. 8 refs., 1 fig., 1 tab.

30581 (SAND–88-2521C) **Relevance of partial saturation to the mechanical behavior of tuffs.** Nimick, F.B.; Peters, R.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890628–10: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number

DE89010435/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, equivalent confining pressures are estimated for samples of tuff using an expression that relates capillary pressure and effective confining pressure to the saturation state of the pores. These confining pressures are compared to the pressures calculated from strain measurements during drying; the calculations use elasticity theory. It is found that stresses and strains are caused by capillary forces in certain partially saturated rocks. This phenomenon has a direct impact on experiments that rely on strain measurements to calculate a rock property. Specific problem areas are the performance of unconfined mechanical tests, calculation of elastic parameters from laboratory data on unjacketed samples, and determination of in situ stress by any method involving stress relaxation.

30582 (SAND–88-2535C) **Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt.** Munson, D.E.; Fossum, A.F.; Senseny, P.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890628–4: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89005777/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The discrepancies between predicted and measured WIPP in situ Room D closures are markedly reduced through the use of a Tresca flow potential, an improved small strain constitutive model, an improved set of material parameters, and a modified stratigraphy. 17 refs., 8 figs., 1 tab.

30583 (SAND–88-2650C) **Experiments in rock mechanics for the site characterization of Yucca Mountain.** Blejwas, T.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890628–2: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89005607/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The site characterization of Yucca Mountain, candidate site for a repository for high-level radioactive waste, will include an experimental program in rock mechanics that presents a challenge beyond common experience. To obtain the necessary levels of confidence in results and conclusions that will support licensing of a repository, numerous carefully controlled and documented experiments are required. Data from the experiments will be used to validate advanced analytical methods, expand the database for empirical approaches, demonstrate rock-mass behavior under simulated repository conditions, and provide input for repository performance assessments. Although some experiments are relatively straight forward, others will require development or modification of state-of-the-art techniques, equipment, or instruments. 5 refs., 4 figs.

30584 (SAND–88-2734C) **3D thermal stress analysis of WIPP room T RH TRU experiments.** Arguello, J.G.; Molecke, M.A.; Beraun, R. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890628–1: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89005207/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A three-dimensional finite element thermal stress analysis of the RH TRU experiments in WIPP Room T has been performed. This analysis aids in the interpretation of the borehole closure results being obtained from the Room T experiments and helps in assessing potential performance impacts in a typical storage room, during the waste retrieval period. Computed results are presented and compared to available in situ data, and a qualitative agreement between measured and computed closures is seen. Results indicate that if the boreholes are drilled 3 years after excavation of a typical storage room, the closure should not impede retrieval of the canisters during the 5 year waste retrieval period. 11 refs., 10 figs.

30585 (SAND–88-2744C) **Computed and measured responses of a thick-walled hollow cylinder of salt subjected to both homogeneous and inhomogeneous loading.** Morgan, H.S.; Wawersik, W.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890628–7: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89006724/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Closures and closure rates measured around excavations in the bedded salt formations at the Waste Isolation Pilot Plant (WIPP) were at least three times larger than initial predictions made with a references creep model for rock salt. Subsequent investigations uncovered a number of potential sources of error including questions about the constitutive behavior of salt in situ. In addition, controlled laboratory experiments on thick-walled hollow cylinders of salt, subjected to various combinations of axial load, internal pressure, external pressure, and temperature, were suggested as one expedient and cost-effective means of narrowing the existing uncertainties. Two recent tests on thick-walled cylinders of rock salt are discussed in this paper to explore the merits of this type of experiment and to address four concerns: (1) differences between behavior of salt core in the laboratory and behavior of salt masses in situ due to, e.g., hardening and damaging during sample extraction, (2) generalization of triaxial measurements to three dimensions requiring choices of stress measures and flow rules, (3) effects of inhomogeneous stress states with gradients as opposed to homogeneous stress fields, and (4) effects of pressure and moisture. 12 refs., 5 figs., 1 tab.

30586 (SAND–88-2778C) **An estimate of the contribution of spent fuel products to the releasable source term in spent fuel transport casks.** Rashid, Y.R.; Barrett, P.R.; Malinauskas, A.P.; Sanders, T.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–16: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013595/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The radioactive source terms pertinent to spent fuel transport cask safety assessments are of three distinct origins; residual contamination within the cask due to previous transport and handling operations, "crud" deposited on the fuel rods in the course of reactor operation, and the radioactive material contained within the rods. Although the last source overwhelms the others in terms of inventory, its release into the cask, and thence into the biosphere, requires the breach of an additional release barrier, viz., the fuel rod cladding. Hence an evaluation of the fuel source term is complicated by the need to address the likelihood of fuel cladding failure during transport. A comprehensive methodology is being developed to accurately describe fuel rod response to severe impacts which includes the extent of release of radioactive material in the event of fuel cladding failure. The analysis model allows for the various levels of interaction that could occur, namely, between the cask basket and assemblies, between assemblies, and between rods. Using as-transported conditions and material properties of spent fuel, analyses have been conducted for various levels of geometric modeling details, including multi-assemblies, single assemblies, and single rod configurations. For cask design purposes, the maximum impact loading on the fuel rods that need be considered is that resulting from 0.3 meter and 9 meter drops of the loaded cask onto an unyielding target. If it is assumed that the cask body is infinitely rigid, energy absorption is limited only to the impact limiters of the cask, providing a conservative estimate of the deceleration forces imparted by the cask to its contents. 7 refs., 1 tab.

30587 (SAND–88-2823C) **The use of a thermal probe to determine the effective thermal conductivity of packaging contents.** Moya, J.L.; Acton, R.U. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–29: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012656/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The thermal conductivity of simulated CH-TRU waste was successfully measured at ambient conditions using the line source thermal conductivity probe technique. The "atypical" probe (i.e., larger in diameter) used for this application was successfully

adapted to existing hardware and software. The portable automated instrumentation system is ideally suited for remote field experiments. Results of the experimental program indicate the line source thermal conductivity probe technique can provide a reliable, nondestructive, and easily implemented method for determining the thermal conductivity of actual CH-TRU waste. However, further experimental study is warranted to develop a disposable-piercing type of probe optimized for measuring the conductivity of CH-TRU waste at generating sites. 8 refs., 5 figs., 2 tabs.

30588 (SAND–88-2826C) **Comparison of analysis methods for burnup credit applications.** Brady, M.C.; Renier, J.P.; Parks, C.V.; Sanders, T.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Nuclear Energy. DOE Contract AC04-76DP00789. (CONF-890631–20: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012572/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents the analysis methodology that has been developed for evaluating the physics issues associated with burnup credit. It is applicable in the validation and characterization of fuel isotopics as well as in determining the influence of various analysis assumptions in terms of Δk_{eff}. The methodology is used in the calculation of reactor restart criticals and analysis of a typical burnup credit cask. 7 refs., 1 fig., 2 tabs.

30589 (SAND–88-3410C) **Results of pressurized-slot measurements in the G-Tunnel underground facility.** Zimmerman, R.M.; Mann, K.L.; Dodds, D.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890628–3: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89005597/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A rock-mechanics field-testing program is underway at Sandia National Laboratories (SNL) as part of the YMP. SNL has the responsibility for assessing the repository design and performance as well as characterizing the geomechanical behavior of the rock. SNL has conducted field experiments in G-Tunnel in Rainier Mesa at the NTS, where tuffs similar to those at Yucca Mountain, the potential repository site, are found. Later experiments are planned as part of the YMP Exploratory Shaft investigations at Yucca Mountain. Major geomechanical factors in repository developments are determinations of the stress state and the deformability of the rock mass (described by the modulus of deformation). One feature of SNL's rock-mechanics program was the development of a testing program for cutting thin slots in a jointed welded tuff and utilizing flatjacks for pressurizing these thin-slots on a relatively, large scale. Objectives in the pressurized-slot testing in G-Tunnel have been to apply and possibly improve methods for (1) utilizing the flatjack cancellation (FC) method for measuring stresses normal to the slot and (2) measuring the modulus of deformation of the jointed rock surrounding the slot. This paper discusses the results of field measurements in and around a single slot and evaluates potential applications and limitations. 10 refs., 1 fig., 4 tabs.

30590 (SAND–89-0178) **Preliminary plan for disposal-system characterization and long-term performance evaluation of the Waste Isolation Pilot Plant.** Bertram-Howery, S.G.; Hunter, R.L. (eds.). Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 464p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89012559/JAW. Available from NTIS, PC A20/MF A01 - OSTI; GPO Dep.

The US Department of Energy is planning to dispose of transuranic wastes at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico. Sandia National Laboratories is responsible for evaluating the compliance of the WIPP with the Environmental Protection Agency's Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes (40 CFR 191, Subpart B). This plan has been developed to present the issues that will be addressed before compliance can be evaluated. These issues examine the procedural nature of the Standard, and the technical requirements for further characterizing the behavior of the disposal system, including uncertainties, to support the compliance assessment. The plan briefly describes the activities that will be conducted prior to 1993 by Sandia to characterize the WIPP disposal system's behavior and predict its performance. 41 refs., 35 figs., 21 tabs.

30591 (SAND–89-0559C) **Design verification testing.** Madsen, M.M.; Uncapher, W.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–10: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013590/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Type B packagings for transporting radioactive materials are required to survive exposures to environments in accordance with provisions. Testing, analyses, or a combination of testing and analysis may be used to demonstrate compliance with the normal and hypothetical accident conditions. This paper will discuss drop and puncture design verification testing. The extensive scale model design verification testing program conducted to evaluate the structural response of the Defense High Level Waste (DHLW) truck transportation cask will be used as an example. General aspects of design of the scale model, drop orientations, instrumentation, photography, nondestructive evaluations (NDE), data evaluations, test plans, and quality assurance can be applied to other design verification programs. 7 refs., 2 figs., 1 tab.

30592 (SAND–89-0560C) **A method for evaluating structural transducers used in Type B package testing.** Madsen, M.M.; Uncapher, W.L.; Bronowski, D.R.; Stenberg, D.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–14: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013591/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

As a result of an agreement between DOE and the Nuclear Regulatory Commission (NRC), each transport cask must be certified by the NRC. To meet these requirements, OCRWM is undertaking a program to design, test, certify, and fabricate a variety of cask systems. Design verification tests will be performed by the cask contractor to demonstrate design safety and to aid in cask certification by the NRC. During Type B packaging design verification testing designers may verify analytical calculations with instrumentation data. Many packagings are tested with accelerometers and strain gages, collectively known as transducers, that measure structural response. Accelerometers measure acceleration and strain gages measure surface strain at the mounted location. This paper describes a method developed for OCRWM to evaluate various transducers of these two types that have been suggested for use in design verification testing. Typically transducers are characterized by the manufacturer under laboratory conditions. In this program ruggedness, failure frequency, repeatability, and manufacturer's data under field and laboratory conditions were investigated. Specific cask model test require transducers with specific ranges; transducers of the selected types were procured with ranges appropriate for this test. 3 refs., 10 figs., 1 tab.

30593 (SAND–89-0608C) **The development of a mobile instrumentation data acquisition system for use in cask testing.** Uncapher, W.L.; Dickinson, J.R.; Althaus, B.L.; Holten, J.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–19: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013602/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Packagings for transporting radioactive materials are required to survive exposure to environments. Package designers investigate design and analysis problems through structural and thermal testing of various components or models, using instrumentation to measure physical responses. The acquisition of high quality data from instrumentation is an essential part of the testing activity. To provide this quality of data, we are developing a mobile instrumentation data acquisition system dedicated for use in cask testing. This system is designed to acquire and analyze structural and thermal test data,

and to provide leakage measurement capabilities. The mobile instrumentation system is housed in a 13.4m (44-ft) trailer transporter, which is self-contained with air conditioning, heating, and halon fire protection systems. External power from a commercial or motor generator source is line conditioned prior to distribution to the data acquisition equipment inside the trailer, and lightning protection is provided at the point where the measurement devices interface to the data acquisition equipment. This system is capable of performing data analyses and display of the acquired information within thirty minutes after an experiment.

30594 (SAND–89-0807C) **An analysis of the consequences of accidents involving shipments of multiple Type A radioactive material (RAM) packages.** Finley, N.C.; McClure, J.D.; Reardon, P.C.; Wangler, M. Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–24: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012641/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Comparing the results of the RADTRANIII calculations with a normalized set of results, both for incident-free transport and vehicular accident cases, the calculated consequences in the current analysis are lower. Even for the High-Activity Shipment, the total expected population dose from either incident-free transport or vehicular accidents is small, and smaller than that estimated in USNRC 1977. The results of the simulation in which parameters were varied randomly and independently indicate that, regardless of the input values assumed, the maximum total population dose from the High-Activity Shipment and the simultaneous occurrence of the least conservative value for each input parameter might be as high as 300 person-rem for a single shipment. The values for either of the other shipments (DOT Exemption or Common Carrier) would be significantly lower. The potential average individual radiation doses from accidents involving multiple Type A package shipments are comparable to the increase in the normal background radiation dose of 0.09 rem/person/year (90 mrem) that an individual would receive by moving from sea level to 5000 ft elevation. The maximum dose to an individual (one very near the accident scene) for the High Activity Shipment would be approximately 0.3 rem (300 mrem) in a maximum severity accident. This is within the individual dose guidelines outlined by NCRP (0.5 rem). Even at the high levels postulated for multiple package shipments under DOT controlled exemptions, the potential risks to the public in terms of expected population dose in the current analysis are below those already found to be acceptable. 4 refs., 3 tabs.

30595 (SAND–89-0915C) **Advanced handling technology project and implications for cask design.** Griesmeyer, J.M.; Bennett, P.C.; Sanders, T.L. Sandia National Labs., Albuquerque, NM (USA). 16 May 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–26: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012659/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes the results of the ongoing Advanced Handling Technologies Project (AHTP) at SNL. AHTP was initiated in 1986 to explore the use of advanced robotic systems to perform cask handling operations at radioactive waste handling facilities and to provide guidance to cask designers regarding the impact of robotic handling on cask design. The proof of concept systems developed in AHTP are intended to extrapolate from currently available commercial systems to those that would be available by the time that an actual repository would be open for operation. These systems provide test facilities for the investigation of the robotic handling of alternate cask design features. The following sections describe: (1) the approach used in AHTP to select operations for proof of concept robotic systems and to identify the cask design implications; (2) the separate proof of concept robotic systems developed in AHTP; and (3) preliminary insights into the impact of cask system design features on the feasibility of robotic performance of cask handling operations. 11 refs., 2 figs., 2 tabs.

30596 (SAND–89-0921C) **An analysis of the background and development of regulations for the air transport of plutonium in the USA.** McClure, J.D.; Luna, R.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–27: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012640/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Several aspects of special packagings of plutonium for air transport should be recognized. The accident cases cited by Congressman Scheuer were incidents of local plutonium contamination in military aircraft accidents that had nuclear weapons on board. There is no disputing the occurrence of these military accidents but military weapon shipments were exempted from the provisions of the Scheuer amendment. There have been no recorded civilian aircraft crashes involving plutonium dispersal although there have been civilian aircraft crashes that were severe. Shortly after the introduction of the amendment by Mr. Scheuer on June 20, 1975, there was a serious aircraft crash at JFK International. In his remarks to the House on July 24, 1975 Mr. Scheuer called attention to this event. The NRC originally opposed the provisions of the Scheuer amendment but with the passing of the amendment NRC compiled with its provisions. This led to the development of the plutonium air transport package PAT-1 in the US. The introduction of special rules for the air transport of plutonium into the US packaging regulations has been made them more severe than the provision of the international regulations, IAEA Safety Series 6. The IAEA is now discussing proposed regulations related to the air transport of plutonium. An additional legislative action was introduced the US in December 1987 which would require actual crash tests of packages intended for the air transport of plutonium, the Murkowski amendment. 13 refs.

30597 (SAND–89-0922C) **An analysis of severe air transport accidents.** McClure, J.D.; Luna, R.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–23: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012642/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The objective of this paper is to analyze the severity of aircraft accidents that may involve the air transport of radioactive materials (RAM). One of the basic aims of this paper is to provide a numerical description of the severity of aircraft transport accidents so that the accident severity can be compared with the accident performance standards that are specified in IAEA Safety Series 6, the international packaging standards for the safe movement of RAM. The existing packaging regulations in most countries embrace the packaging standards developed by the IAEA. Historically, the packaging standards for Type B packages have been independent of the transport mode. That is, if the shipment occurs in a certified packaging, then the shipment can take place by any transport mode. In 1975, a legislative action in the US Congress led to the development of a package designed specifically for the air transport of plutonium. Changes were subsequently made to the US packaging regulations to incorporate the plutonium air transport performance standards. These standards were used to certify the air transport package for plutonium which is commonly referred to as PAT-1 (US NRC). The PAT-1 was certified by the US Nuclear Regulatory Commission in September 1978. 6 refs., 4 figs., 4 tabs.

30598 (SAND–89-0935C) **Thermal analyses of a generic rail cask model and thermal response of a test article using different high temperature boundary conditions.** Moya, J.L.; Brown, N.N. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–11: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013589/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Over the past several years, there have been ongoing discussions about the attempt to compare the thermal hypothetical accident environment in the Nuclear Regulatory Commission (NRC) regulations for the packaging and transportation of radioactive

materials and the thermal qualification test conditions in the Department of Transportation's (DOT) thermal insulation specifications for tank cars. This paper discusses the purposes and differences of each test environment and shows the relative magnitude of error that can occur when applying these regulations inappropriately. The purpose of the NRC regulations governing the packaging and transportation of radioactive materials is to assure that the transportation cask is designed safely and will protect the public in the event of an accident. Radiological criteria, such as radioactivity release and radiation levels external to the cask, are specified. Contained in these regulations are severe performance standards which outline sequential mechanical and thermal loads that the package must be designed to withstand. The sequential nature of the tests are an important consideration. By the time a package is subjected to the thermal environment, it may already have sustained a significant amount of structural damage. The regulations do not define allowable structural or thermal damage to the package; instead the cask integrity must maintain stringent containment, shielding, and criticality specifications. 10 refs., 4 figs.

30599 (SAND–89-0937C) **Design basis for resistance to shock and vibration.** Glass, R.E.; Gwinn, K.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–21: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013447/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories, in conjunction with its participation in the American National Standards Institute (ANSI) writing groups, has undertaken to provide an experimental and analytical basis for the design of components of radioactive materials packages to resist normal transport shock and vibration loads. Previous efforts have resulted in an overly conservative shock spectra description of the loads in the tie-downs and cask attachment points anticipated during normal shipment. The present effort is aimed at predicting the actual loads so that the design basis can be accurately determined. This goal is being accomplished with road simulator and over-the-road tests and the development of an analytical model. This model is used to parametrically evaluate and envelop the transportation systems' responses. The parameters to be varied include damping, stiffness, geometry, and cargo mass. The over-the-road tests provide operational data that are used to validate the selection of environments for the road simulator tests. The road simulator tests provide verification for the model. This verification is accomplished since the road simulator tests provide not only the system response which can be measured in over-the-road tests but also the system input. Finally, when the model has been verified, it can be used to vary parameters to envelop a wide range of normal transport conditions.

30600 (SAND–89-0962C) **Design aspects of plutonium air-transportable packages.** Allen, G.C.; Moya, J.L.; Pierce, J.D.; Attaway, S.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–28: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012655/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Recent interest in the development of new and larger plutonium air transport packages has resulted in an improved understanding of the performance of wood-based packages. New computer models have been developed that can serve as design tools for these packages in the future. This information gives us an optimistic outlook on the ability to design plutonium air-transportable packages that can survive severe aircraft accidents. 8 refs., 3 figs., 1 tab.

30601 (SAND–89-1213C) **Heat transfer in severe accident simulations.** Keltner, N.R.; Sobolik, K.B.; Moya, J.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–25: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012660/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

For cask designers to improve analytical thermal modeling capabilities, it is important to define the "thermal insult" a fire test provides to a package. In order to define the thermal environment, temperature and heat flux measurements must be obtained. This paper discusses a range of experimental measurement techniques. Since temperature and heat flux measurements can present a large source of error, the uncertainty in experimental measurements is emphasized. Uncertainties in heat flux for furnace and fire tests can range from 10 to 50 percent. For example, the heat flux to the test item (in a fire or furnace) can be underpredicted if the readings from an unshielded thermocouple are used in calculating the heat flux. If a slug calorimeter is used to measure the heat flux, the calorimeter must be of similar size as the test unit. The measured peak heat flux may be higher than that experienced by the test unit if the calorimeter and test unit are not similar. In conclusion, it is important to be able to skillfully make measurements in a fire, and equally important to know or be able to estimate the accuracy of the measurement. 17 refs., 6 figs.

30602 (SAND–89-1224C) **Force and moment reconstruction for a nuclear transportation cask using sum of weighted accelerations and deconvolution theory.** Yoshimura, H.R.; Bateman, V.; Carne, T.G.; Gregory, D.L.; Attaway, S.W.; Bronowski, D.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–30: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013166/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A 9-m drop test was conducted of a 1/3-scale-model spent fuel cask onto an unyielding target. The structural response of the impact limiters and attachments wa evaluated. A mass model of the cask body, with steel-sheathed redwood and balsa impact limiters, was tested in a 10-degree slapdown orientation. One end of the cask impacted the target before the other end, as shown in Figure 1, with higher deceleration forces resulting from the second impact. The information desired from this test is the deformation of the two impact limiters on either end of the cask as a function of the applied force. The content in this paper will only discuss a summary of the applied force calculations. Two new force reconstruction techniques were applied to the slapdown test data; the same of weighted accelerations (SWA) and deconvolution (DECON). The conventional method for determining the resultant force involves post-test digitally filtering an accelerometer measurement to find the rigid-body acceleration for the cask. The rigid-body acceleration is then multiplied by the cask mass to obtain an estimate of the applied force. The frequency content of this force is restricted to the cut-off frequency of the digital filter, typically about one-half of the lowest elastic mode of the cask. The conventional method also restricted the rise time if the force to the rise time of the digital filter. The new force reconstruction techniques demonstrate the potential for a better estimate of forces acting on the cask during the impact than the conventional method.

30603 (SAND–89-1257C) **Issues pertinent to sealing of radioactive waste repositories in bedded salt formations.** Nowak, E.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8905136–1: Joint NEA/CEC workshop on sealing of radioactive waste repositories, Braunschweig, Germany, F.R., 22-25 May 1989). Order Number DE89011394/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Several issues have been identified as pertinent to sealing of radioactive waste repositories in bedded salt formations. These issues include: overall seal system functions and strategy for waste isolation; performance requirements for the seal system; need for redundancy; locations of long-term seals in excavations and boreholes; requirements for sealing interbeds and the disturbed rock zone (DRZ) seal stability for the required lifetime; and need for short-term seals in addition to long-term seals. These issues are defined in general terms, and some principles that may be useful in addressing them are presented. Although this presentation derives from experience with bedded salt, it has applicability to domal salt as well.

30604 (SKB-JSSP-TR–88-01) **Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass.** Jercinovic, M.J.; Ewing, R.C.; A CRIEPI, NAGRA, SKB collaboration. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1987. 239p. Order Number DE89614667/JAW. Available from NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS.

The report provides a detailed analysis of the alteration process and products for natural basaltic glasses. Information of specific applicability to the JSS project include: * The identification of typical alteration products which should be expected during the long-term corrosion process of low-silica glasses. The leached layers contain a relatively high proportion of crystalline phases, mostly in the form of smectite-type clays. Channels through the layer provide immediate access of solutions to the fresh glass/alteration layer interface. Thus, glasses are not 'protected' from further corrosion by the surface layer. * Corrosion proceeds with two rates - an initial rate in silica-undersaturated environments and a long-term rate in silica-saturated environments. This demonstrates that there is no unexpected change in corrosion rate over long periods of time. The long-term corrosion rate is consistent with that of borosilicate glasses. * Precipitation of silica-containing phases can result in increased alteration of the glass as manifested by greater alteration layer thicknesses. This emphasizes the importance of being able to predict which phases form during the reaction sequence. * For natural basaltic glasses the flow rate of water and surface area of exposed glass are critical parameters in minimizing glass alteration over long periods of time. The long-term stability of basalt glasses is enhanced when silica concentrations in solution are increased. In summary, there is considerable agreement between corrosion phenomena observed for borosilicate glasses in the laboratory and those observed for natural basalt glasses of great age. (With 121 refs.) (authors).

30605 (SKN–20) **Time orientation, planning horizons and responsibility into the future.** Svenson, O.; Nilsson, G. National Board for Spent Nuclear Fuel, Stockholm (Sweden); Stockholm Univ. (Sweden). Jan 1988. 45p. Order Number DE89775048/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Subjects of four categories (social science students, engineering students, retired people and nuclear waste experts) were asked about past events, planning, risks and future time with emphasis on energy related issues and in particular questions concerning spent nuclear waste. Among, the results reported it was found that events in the past were located more or less correctly and that events further back systematically too close to the present. Today's responsibility into the future was judged to cover 3 to 6 generations ahead and an adequate planning horizon for a local community to be on the average 11 to 14 years. Adequate planning horizons for the handling of spent nuclear fuel were judged to be from 100 to 500 years. The responsibility for effects of today's decisions was judged to be from about 100 to 300 years into the future for environmental pollution and from about 50 to 600 years for nuclear waste. However, non-negligable proportions of the subjects choose a more moral standpoint and gave answers indicating that responsibility had to be unlimited. Some sex differences were found and an interaction with age offered as a hypothesis to be investigated in the future. Interrelations between clusters of questions revealed some links from past time and planning to judgements of environmental and nuclear power related risks.

30606 (SKN–21) **Psychological aspects of nuclear waste disposal: Long time perception and the question of discounting of risks.** Karlsson, G.; Svenson, O. National Board for Spent Nuclear Fuel, Stockholm (Sweden); Stockholm Univ. (Sweden). Jan 1988. 44p. Order Number DE89775049/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Subjects of different ages and basic training indicated how they perceived risks related to spent nuclear fuel storage and located at different points of time into the future. The results indicated that minorities in all groups, ranging from about 10 to 40%, did not want to discount risks into the future. Those who discounted exhibited great inter and intra group variability. The physical discounting curves for e.g. both total radiation and for Pu-239 and -240 are within the range of curves generated by the groups for subjective discounting of risk. Politicians and experts were attributed equal shares of responsibility for risks of spent nuclear fuel in the future. About 10% to 40% of the subjects did not wish to discount responsibility. Discounting rates for those discounting varied so that some subjects decreased the level of responsibility to less than half 10 000 years into the future while others attributed this level of responsibility for 100 000 years and more.

30607 (SSI–88-21) **English translation of three documents relating to the SFR-1. Operating permission. Radiation protection instructions. Chapter 4 of the assessment memorandum.** National Inst. of Radiation Protection, Stockholm (Sweden). 26 Sep 1988. 61p. Order Number DE89764822/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Translated from Swedish.

After approval from the National Institute of Radiation Protection, (the SSI) on April 26th, 1988 the Swedish Nuclear Fuel and Waste Management Company, the SKB, put the Final Repository for Radioactive Waste, the SFR-1 (Forsmark), into operation. This report contains English translations of the Operating Permission issued by SSI and the associated radiation protection instructions. Also included is a translation of chapter 4, the viewpoints and evaluations, of the Assessment Memorandum which was the background material for the Board of the SSI when deciding on the operational permission.

30608 (STRIPA–88-11) **Rock sealing - Interim report on the rock sealing project (stage 1).** Pusch, R.; Boergesson, L.; Fredrikson, A.; Markstroem, I.; Erlstroem, M.; Ramqvist, G.; Gray, M.; Coons, B. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Sep 1988. 195p. Order Number DE89775047/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

The objective of the Sealing Project is to find ways of sealing finely fractured rock by grouting. This requires development of new injection technique as well as to identify materials which are sufficiently fluid to be groutable and acceptably low-previous and physically and chemically stable. The present report describes the results of the first two years of investigation (stage 1), which gave very positive results as concluded from a large field-scale test.

30609 (STRIPA-TR–88-03) **Site characterization and validation. Borehole radar investigations, Stage 1.** Olsson, O.; Eriksson, J.; Falk, L.; Sandberg, E. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1988. 173p. Order Number DE89617428/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The borehole radar investigation program of the SCV-site (Site Characterization and Validation) has comprised single hole reflection measurements with centre frequencies of 22, 45, and 60 MHz. The radar range obtained in the single hole reflection measurements was approximately 100 m for the lower frequency (22 MHz) and about 60 m for the centre frequency 45 MHz. In the crosshole measurements transmitter-receiver separations from 60 to 200 m have been used. The radar investigations have given a three dimensional description of the structure at the SCV-site. A generalized model of the site has been produced which includes three major zones, four minor zones and a circular feature. These features are considered to be the most significant at the site. Smaller features than the ones included in the generalized model certainly exist but no additional features comparable to the three major zones are thought to exist. The results indicate that the zones are not homogeneous but rather that they are highly irregular containing parts of considerably increased fracturing and parts where their contrast to the background rock is quite small. The zones appear to be approximately planar at least at the scale of the site. At a smaller scale the zones can appear quite irregular. (authors).

30610 (UCID–21700) **Yucca Mountain Project waste package design for MRS [Monitored Retrievable Storage] system studies.** Nelson, T.; Russell, E.; Johnson, G.L.; Morissette, R.; Stahl, D.; LaMonica, L.; Hertel, G. Lawrence Livermore National Lab., CA (USA). Apr 1989. 136p. Sponsored by DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. Order Number DE89012806/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report, prepared by the Yucca Mountain Project, is the report for Task E of the MRS System Study. A number of assumptions were necessary prior to initiation of this system study. These assumptions have been defined in Section 2 for the packaging scenarios, the waste forms, and the waste package concepts and materials. Existing concepts were utilized because of schedule constraints. Section 3 provides a discussion of sensitivity considerations regarding the impact of different assumptions on the overall result of the system study. With the exception of rod consolidation considerations, the system study should not be sensitive to the parameters assumed for the waste package. The current reference waste package materials and concepts are presented in Section 4. Although stainless steel is assumed for this study, a container material has not yet been selected for Advanced Conceptual Design (ACD) from the six candidates currently under study. Section 5 discusses the current thinking for possible alternate waste package materials and concepts. These concepts are being considered in the event that the waste package emplacement environment is more severe than is currently anticipated. Task E also provides a concept in Section 6 for an MRS canister to contain consolidated fuel for storage at the MRS and eventual shipment to the repository. 5 refs., 14 figs., 10 tabs.

30611 (UCRL–21060-87-2) **NNWSI [Nevada Nuclear Waste Storage Investigation] waste form testing at Argonne National Laboratory: Semiannual report, July–December 1987.** Bates, J.K.; Gerding, T.J.; Ebert, W.L.; Mazer, J.J.; Biwer, B.M. Argonne National Lab., IL (USA). Jul 1988. 97p. Sponsored by DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. Order Number DE89013174/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Tests are ongoing at Argonne National Laboratory to examine the reaction of glass with water under conditions that may exist in the proposed repository at Yucca Mountain, Nevada. Examination of glass reaction using the Unsaturated Test method as applied to simulated defense glass (SRL 165 black frit based) and simulated West Valley glass (ATM-10) is ongoing. The tests on SRL 165 glass have been ongoing for 104 weeks with nonstoichiometric release of Li, Na, B, and actinide elements being observed throughout the test period. The tests on ATM-10 glass have been in progress for 26 weeks and it is too early in the test cycle to assess the glass reaction. The influence of penetrating gamma radiation on the reaction of synthetic nuclear waste glasses in tuff groundwater was also investigated. Modified MCC-1 static leaching experiments were performed under radiation exposures of 1×10^3 R/h and O R/h at 90°C. The groundwater was acidified by nitrous and nitric acids radiolytically produced in the air. The high bicarbonate ion concentration of the groundwater prevented the pH from dropping below 6.4, however. The glass reaction, as measured by the release of glass species and the thickness of an alteration layer formed on the glass surface, was not measurably affected by radiation. 24 refs., 34 figs., 20 tabs.

30612 (UCRL–53615-87) **Earth Sciences annual report, 1987.** Younker, L.W.; Donohue, M.L.; Peterson, S.J. (eds.). Lawrence Livermore National Lab., CA (USA). Dec 1988. 77p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89013344/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Earth Sciences Department at Lawrence Livermore National Laboratory conducts work in support of the Laboratory's energy, defense, and research programs. The Department is organized into ten groups. Five of these – Nuclear Waste Management, Fossil Energy, Containment, Verification, and Research – represent major programmatic activities within the Department. Five others – Experimental Geophysics, Geomechanics, Geology/Geological Engineering, Geochemistry, and Seismology/Applied Geophysics – are major disciplinary areas that support these and other laboratory programs. This report summarizes work carried out in 1987 by each group and contains a bibliography of their 1987 publications.

30613 (UCRL–100395) **Waste package performance assessment for the Yucca Mountain Project.** O'Connell, W.J.; Lappa, D.A.; Thatcher, R.M. Lawrence Livermore National Lab., CA (USA). Feb 1989. 14p. Sponsored by DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. (CONF-890207–29: Waste management '89, Tucson, Arizona, USA, 26 Feb - 2 mar 1989). Order Number DE89011898/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We completed a first cycle of model development from a specification to a computer program, PANDORA-1, for long-term performance assessment of waste packages. The model for one waste package at a time incorporates processes specific to the unsaturated environment at the proposed Yucca Mountain, NV, site. PANDORA-1 models the most likely processes and several modes of waste alteration and release. The development identified information needs for future models; many processes, local details, and combinations will have to be examined. Integration of ensemble performance and quantification of uncertainties are modeling steps at higher aggregation. Methodologies for these steps include sampling, which is well studied; we have focused on several open questions. We can now calculate the amount of variance reduction available from Latin hypercube sampling; it is a limited reduction. A new method, controlled sampling, provides substantial variance reduction for a broad range of model functions. An uncertainty analysis test-bed program compares the new with old sampling methods. 7 refs., 1 tab.

30614 (WHC-EP–0182-12) **Tank farm surveillance and waste status summary report for March 1989.** Thurman, J.M. Westinghouse Hanford Co., Richland, WA (USA). May 1989. 28p. Sponsored by DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE89013158/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is Westinghouse Hanford Company's official inventory for high-level radioactive waste stored in underground tanks at the Hanford Site. Data that depict the status of stored, high-level waste and tank vessel integrity are contained within the report. The intent of the report is to provide data on each of the existing 177 underground waste tanks, as well as to provide supplemental information regarding tank equipment, tank anomalies, and ongoing investigations.

30615 (WHC-EP–0195) **Encapsulated cesium and strontium preliminary description of waste form and canister.** Ward, A.L.; Hoza, M.; Buelt, J.L. Westinghouse Hanford Co., Richland, WA (USA). May 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE89012948/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This document preliminarily describes the waste form and canisters for cesium and strontium capsules stored at the Hanford Site. This document was prepared as a first issue to preliminarily fulfill the reporting requirements of the waste acceptance process for the US Department of Energy's Office of Civilian Radioactive Waste Management. The waste acceptance process is the means by which defense high-level waste producers will develop waste acceptance requirements for permanent disposal at candidate geologic repositories. The characteristics of the waste form and disposal canister, including the chemical form, radionuclide inventories, chemical stability, and the number and size of the canisters necessary for disposal are described. The characteristics of the canistered capsules, including the presence of free liquids, gas, and free volume are also described. The chemical compatibility of the capsule contens with its canister is also discussed. 16 refs., 2 figs., 2 tabs.

30616 (WSRC-RP–89-12) **Selection of materials for Savannah River Site Consolidated Incinerator Facility (CIF) offgas system.** Sanders, L.N.; Kelly, P.N. Westinghouse Savannah River Co., Aiken, SC (USA); Main (Charles T.), Inc., Charlotte, NC (USA); Parsons (Ralph M.) Co., Charlotte, NC (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001;AC09-89SR18035. (CONF-890521–8: 8. international conference on thermal destruction of hazardous, radioactive, infectious and mixed wastes, Knoxville, Tennessee, USA, 1-5 May 1989). Order Number DE89011624/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses the choice of materials of chloride containing flue gases, and quench and scrub solutions in the Consolidated Incineration Facility (CIF) (under design for Westinghouse/Bechtel) for incineration of radioactive and hazardous waste. This facility is located at the Savannah River Site in Aiken, South Carolina. A process need is to minimize blowdown waste. Chloride levels in the

quench/scrub solutions up to 1 percent as acid or 10 percent as sodium chloride are expected. For low temperature portions of the system (up to 87°C, 190°F) polypropylene lined pipe and Derakane® 470-36 resins for FRP vessels are used. For service up to 250°F, Halar® lined carbon steel is used, and for service up to 93°C (200°F) Flakeline® 103 lined carbon steel is used. For higher temperature portions of the system (up to 1000°F) Hastelloy® alloy C-22 is used. Provisions for containment of low level radioactive gases as it affects materials selection are discussed in this article. Design of emergency quenching systems to avoid temperature excursions which could result in failure leading to hazardous emissions are presented. Technical discussion of material thermal stabilities, aqueous corrosion data, pitting, and crevice corrosion is also given.

30617 The Defense Waste Processing Facility. Brumley, W.J. (Defense Waste Processing Facility Project Office, U.S. Dept. of Energy, Aiken, SC (US)). v.v of Nuclear waste management II. Passchier, W.F.; Bosnjakovic, B.F.M. American Ceramic Society Inc., Westerville, OK (1986). (CONF-8608225–: 3. international symposium on ceramics in nuclear waste management, Chicago, Illinois, USA, 28-30 Aug 1986).

The Defense Waste Processing Facility (DWPF) is the United States' first production-scale facility and the world's largest plant for the vitrification of high-level nuclear waste. The DWPF, which is under construction at the Department of Energy's Savannah River Plant (SRP), will immobilize the highly radioactive fraction of over 33 million gallons of high-level nuclear waste. The facility is approximately 30% complete and will begin operation in 1990. Through technical and engineering innovation, the estimated cost of the facility was reduced from an original forecast of $2.3 billion to $910 million. This estimate was refined in 1984 to $870 million and has remained constant since. The Savannah River Plant's high-level wastes (HLW) are stored in underground tanks as salts, primarily sodium nitrate, and sludges, primarily metallic oxides and hydroxides. The sludges are pretreated in the waste tank farm prior to transfer to the DWPF. The salt fraction of the waste is decontaminated in the waste tank farm. This decontamination process results in a low-level waste stream which will be disposed of on the SRP site in a cement and fly ash matrix. The HLW stream resulting from the decontamination process is a mixture of cesium and potassium tetraphenyl borate salts.

30618 Tritium penetration through concrete. Eichholz, G.G. (Nuclear Engineering and Health Physics Program, Georgia Institute of Technology, Atlanta, GA (US)); Park, W.J.; Hazin, C.A. *Nuclear and Chemical Waste Management (USA),* 9(1): 27-36 (1989).

Concrete represents the primary barrier to migration in many proposed low-level waste storage facilities. While it may retard some dissolved ions to varying extent, it is not clear to what extent tritium movement through concrete would take place over extended periods. Experimental tests have been performed, with tritium as a tracer, on a series of concrete cylinders of a high slag aggregate composition to measure tritium mobility and to determine its dependence on concrete properties and environmental parameters. It was found that uncoated concrete absorbs water quite rapidly and once wetted, conducts tritium in water at a rate of about 8 x 10/sup -4/ cm/sup 3//cm/sup 2/day. For thick specimens, over 10 cm in thickness, tritium movement is solely determined by porosity and hydraulic conductivity. Diffusion rates can be lowered by a surface finish, by using a smaller stone size in the aggregate and by vibratory compaction. Standing water may provide a hydrostatic head that results in some increase in flow rate, but it too is limited by the terminal value in hydraulic conductivity. Unless the concrete wall is coated or impregnated in some permanent fashion, it appears that little credit can be taken for the concrete walls as a retarding barrier for tritium-bearing liquids.

30619 TRUEX process and the management of liquid TRU waste. Schulz, W.W. (Westinghouse Hanford Company, Richland, WA (USA)); Horwitz, E.P. *Separation Science and Technology (USA),* 23(12-13): 1191-1210 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The TRUEX (TransUranium EXtraction) process is a new generic actinide extraction/recovery process for the removal of all actinides from acidic nitrate and chloride nuclear waste solutions. A brief review of the relevant chemistry of the TRUEX process and a summary of the current status of development and deployment of TRUEX process flow sheets to treat specific acidic waste solutions at several US DOE sites is presented.

0530 Environmental Aspects

Refer also to citation(s) 30524, 30525, 30526, 30527, 30528, 30530, 30531, 30535, 30536, 30537, 30538, 30540, 30562, 30567, 30569, 30570, 30571, 30572, 30573, 30576, 30577, 30578, 30579, 30580, 30581, 30582, 30583, 30584, 30585, 30587, 30589, 30590, 30591, 30592, 30593, 30595, 30596, 30597, 30599, 30600, 30601, 30603, 30610, 30611, 30612, 30613, 30615, 30618, 30879, 30881, 30888, 31907, 32006, 32027, 32780

30620 (ANSTO/E–663) **Rum Jungle tailings dam - chemical profile of the subsoil.** Lowson, R.T.; Evans, J.V.; Sarbutt, J.V.; Sinclair, G.; Folk, E. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Sep 1987. 62p. Order Number DE89616599/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

In a survey of soils below the Rum Jungle uranium mine tailings dam, parameters measured were pH, moisture content, particle distribution, total Cu, water-extractable Cu, Ca and SO/sub 4/and acid-extractable Ra. The cation profile had a marked discontinuity at the soil/tailings interface. This was attributed to a complex hydrogeology and to the presence of a reduction zone in the soil immediately below the tailings. The tailings acted as an aquaclude to a water table which fluctuated with the monsoonal season. The reduction zone acted as a cation trap, preventing cation transport. The radium concentration dropped to levels acceptable to public health within a few centimetres of the soil/tailings interface.

30621 (ANSTO/E–677) **Environmental survey at Lucas Heights Research Laboratories, 1985.** Giles, M.S.; Foy, J.J.; Hoffmann, E.L. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). May 1988. 31p. Order Number DE89616596/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Results are presented of an environmental survey conducted in the neighbourhood of the Lucas Heights Research Laboratories during 1985. No radioactivity which could have originated from these laboratories was found in samples collected from possible human food chains. All low-level liquid and gaseous waste discharges were within authorised limits. The maximum possible annual dose to the general public from airborne waste during this period is estimated to be less than 0.01 millisieverts, which is one per cent of the limit for long-term exposure that is recommended by the National Health and Medical Research Council.

30622 (DOE/ID–12114) **Guidelines for revegetation of disturbed sites at the Idaho National Engineering Laboratory.** Anderson, J.E.; Shumar, M.L. USDOE Radiological and Environmental Sciences Lab., Idaho Falls, ID (USA). Jun 1989. 36p. Sponsored by DOE Energy Research. Order Number DE89013328/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The arid climate of the INEL presents a serious challenge for the reclamation of disturbed sites. Because of limited precipitation and a short growing season, disturbed areas "heal" slowly. Timely and effective revegetation of such sites is necessary to stabilize soil and prevent erosion, preclude colonization by undesirable weeds, and maintain an aesthetically-pleasing landscape. This guide was developed to aid in such revegetation efforts. Planning for reclamation prior to initiating construction or development activities can minimize the areal extent and severity of disturbances and reduce costs associated with reclamation. Suggestions for defining objectives for reclamation projects and examples of specific objectives for revegetation planning at the INEL are provided. Because meeting some objectives in the most expedient manner may preclude or delay meeting others, implications and tradeoffs of various revegetation strategies are discussed. The success of a revegetation project depends on selecting species that are adapted to the soils and climate of the INEL. Characteristics of plant species recommended for revegetation projects are presented. Specific recommendations of

seeding mixtures for restoring natural communities, seeding waste management sites and roadsides, and establishing strips of fire-resistant vegetation are included. Techniques for preparing seedbeds, seeding, and transplanting are discussed. Timing of planting is critical at the INEL and specific recommendations are given. Finally, we provide guidelines for evaluating the success of revegetation projects. 65 refs., 2 figs., 3 tabs.

30623 (INIS-mf–11447) **Application of best practicable technology to water management at Ranger Uranium mine: report of the technical working group.** Office of the Supervising Scientist for the Alligator Rivers Region, Sydney (Australia); Energy Resources of Australia, Sydney (Australia); Ranger Uranium Mines Proprietary Ltd., Chatswood (Australia); Northern Territory Dept. of Mines and Energy, Darwin (Australia). Dec 1986. 43p. Order Number DE89616600/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Open File Record OFR 44.

An assessment is made of best practicable technology (BPT) as applied to the water management system of Ranger Uranium Mines for the period 1986-91. A specification of BPT cannot be made for the indefinite future because major changes in operation of the mine may occur which could have an impact on future water management. It is for these reasons that the period of detailed assessment has been limited to the next 5 years. For the purposes of the report, BPT is considered to be that technology relevant to the Ranger project which produced the minimum environmental pollution and degradation that can reasonably be achieved, having regard to a number of technical factors, including practice in uranium mining elsewhere in the world, cost, evidence of detriment or lack of it, project location and the age and effectiveness of equipment and facilities at Ranger. Three options are presented, in order of preference: no prohibition on release to Magela Creek, limitation on frequency of release to Magela Creek and prohibition on release to Magela Creek.

30624 (IPEN-PUB–233) **Environmental monitoring program of the uranium enrichment facility Almirante Alvaro Alberto.** Hiromoto, G.; Jacomino, V.M.F.; Venturini, L.; Moreira, S.R.D.; Gordon, A.M.P.L.; Duarte, C.L.; Pocequilo, B.R.S.; Mazzilli, B.P. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Nov 1988. 79p. (In Portuguese). Order Number DE89613841/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

In this report, the Environmental Monitoring Program of the Uranium Enrichment Facility Almirante Alvaro Alberto is outlined and the results obtained during the preoperational period are presented. Information concerning the population distribution, the use of water and land, the local agricultural production and the local meteorology are also available. In order to evaluate the levels of the background radiation, sample of water, air and biological and terrestrial indicators were analysed. Measurements were performed of natural gamma emitters concentrations levels and of uranium in air, surface water, precipitation, groundwater, river sediment, soil, grass, vegetation and various foodstuffs. For direct measurement of background radiation levels a solid state dosimeter network was used. Results are also presented for the analysis of non radioactive pollutants in the water samples and for the particles and gaseous fluorides concentration in the atmosphere.

30625 (K/ITP–237) **Nondestructive assay measurements of gaseous diffusion process equipment.** Cooley, J.N.; Fields, L.W.; Hagenauer, R.C.; Herron, S.A.; Mayer, R.L.; Whitaker, J.M. Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div. 22 May 1989. 4p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OT21400. (CONF-890565–1: 11. annual ESARDA symposium on safeguards and nuclear materials management, , Luxembourg, 30 May - 1 jun 1989). Order Number DE89012738/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A nondestructive assay (NDA) measurement survey program has been established at Oak Ridge Gaseous Diffusion Plant in Oak Ridge, Tennessee, to support decontamination and decommissioning (D&D) activities at the shutdown facility. The program's objective is to develop and to implement NDA measurement techniques for estimating the residual uranium contained in the diffusion process equipment and ancillary piping of the shutdown process buildings onsite. Measurement techniques are described, support programs (e.g., technician training, hardware development, and quality assurance) are detailed, and results are summarized. The organization, development, and implementation of a large-scale NDA measurement survey program to provide reliable process holdup data for D&D activities is being successfully demonstrated.

30626 (SSI–88-16) **Chemical risks from nuclear waste repositories.** Persson, L. National Inst. of Radiation Protection, Stockholm (Sweden). 29 Oct 1988. 12p. Order Number DE89613861/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Studies concerning the chemical risks of nuclear waste are reviewed. The radiological toxicity of the material is of primary concern but the potential nonradiological toxicity should not be overlooked as the chemotoxic substances may reach the biosphere from a nuclear waste repository. In the report is concluded that the possible chemotoxic effects of a repository for nuclear waste should be studied as a part of the formal risk assessment of the disposal concept.

0540 Health and Safety

Refer also to citation(s) 30451, 30536, 30705, 31061, 31592, 31828, 32019, 32377, 32378, 32780, 33006

30627 (DOE/ID/12584–39) **Field method for determining thorium-230 in soils.** Dechant, G. UNC Geotech, Grand Junction, CO (USA). May 1989. 28p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-86ID12584. (UNC/GJ–48(TMC)). Order Number DE89012240/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Energy (DOE) Office of Remedial Action and Waste Technology established the Technical Measurements Center at the DOE Grand Junction, Colorado, Projects Office to develop and/or recommend measurement methods for use in support of its remedial action programs. This report describes a field method for the determination of Th-230 in soils for remedial action projects. The method involves a cold acid digestion, organic extraction, and precipitation of Th-230 for counting by alpha spectrometry. An internal Th-228 spike is added early in the method to eliminate the need to determine losses through the separation steps. A step-by-step procedure is included in the report. The method requires a small portable or mobile laboratory equipped with electrical power and ventilation. All additional equipment is commercially available and no special equipment is required. Chemical wastes for each analysis are stored for appropriate disposal off site. A chemist or chemical technician can complete 15–30 analyses per day depending primarily on the number of alpha spectrometers available. 8 refs., 2 figs., 7 tabs.

30628 (OEVS-Mitteilung–1988, pp. 86-94) **Reliability of protection measures used in solving optimization tasks in radiation protection.** Huber, E.L. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

When several options are available costs must be considered versus the risk of failure and the magnitude of harm, to assure an optimal allocation of money. 11 refs., 1 tab. (qui).

30629 (OEVS-Mitteilung–1988, pp. 396-398) **Recurrent analyses of radiation protection conditions at the Swedish nuclear power plants.** Hennigor, S. (National Inst. of Radiation Protection, Stockholm (Sweden)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A complete safety analysis is performed every 10th year for each nuclear power reactor in Sweden. NIRP review the radiation protection conditions. Analyses of different areas gives the status of the radiation protection activities at the reactor unit and points out which fields will require most attention in the nearest future. 6 figs.

30630 (OEVS-Mitteilung–1988, pp. 535-538) **Automatic measuring station to monitor radioactive waste containers.** Kirsch, H. (Herfurth G.m.b.H., Hamburg (Germany, F.R.)); Boeckel, M. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Radioactive waste casks must comply with some requirements on their dose rate, a volume activity and surface contamination, for transport and disposal. Where a large number of casks must be controlled automatic measuring systems are advisable. An automatised cask measuring station, working quickly and with little personnel, is described. A computer system is used for assessment and administration of the cask data. 3 figs. (qui).

0550 Safeguards, Inspection, and Accountability

30631 (CONF-890406–19) **Neutron-gamma hodoscope detection of fissile materials.** DeVolpi, A. Argonne National Lab., IL (USA). 1989. 7p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Fifty years with nuclear fission conference; Gaithersburg, Maryland, USA; 25-28 Apr 1989. Order Number DE89013622/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The neutron-gamma hodoscope has been developed to make use of two aspects of the fission process that occur during severe safety testing of nuclear reactor fuel; fission-product heating that induces realistic effects in the fuel and penetrating radiation that enables the imaging of fuel behavior. During in-pile transient reactor experiments, the radiation which escapes from the test fuel, its surrounding coolant, and a thick-walled container is detected by a large collimated array that produced cineradiographic images. Phenomena observed in hundreds of destructive experiments have included pre-failure fuel motion, cladding breach, and post-failure fuel motion. On the basis of this successful 25-year experience, application of hodoscope techniques to arms control treaty verification is now being studied. 7 refs., 13 figs.

0560 Legislation and Regulations

Refer also to citation(s) 30450, 30526, 30541, 30549, 30596, 30854, 31839

30632 (EPRI-NP–5933, pp. 12.3-12.21) **Passage of the Low-Level Radioactive Waste Act Amendments of 1985.** Farrell, B. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The original Low-Level Waste Act was passed in the final days of the 96th Congress, on December 22, 1980. The High-Level Waste Policy Act was passed in the final days of the 97th Congress, on December 20, 1982. The Low-Level Radioactive Waste Amendments Act was passed on the last day of the first session of the 99th Congress, on December 19, 1985. How do we get into this situation? The author discusses the route by which the 1985 Amendments became law.

30633 (EPRI-NP–5933, pp. 7.1-7.30) **Current regulatory issues.** Johnson, T.C.; Starmer, R.J.; Voglewede, J.; Jungling, T.L.; Person, L.S.; Chang, K.C.; Peterson, C.H. Electric Power Research Inst., Palo Alto, CA (USA); BVC Consultants, Inc., Sun City Center, FL (USA). Oct 1988. In *1986 EPRI radwaste workshop: Proceedings.* Order Number DE89002018/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The purpose of this discussion is to address current regulatory issues applicable to low-level waste disposal practices at nuclear power plants. Topics to be covered include the status of implementation programs for 10 CFR Part 61, the development of regulatory guides for waste form and waste classification, the status of topical report reviews and the impacts of new legislation on NRC programs.

30634 (NUREG/CP–0101) **Workshop on rules for exemption from regulatory control: Proceedings.** Nuclear Regulatory Commission, Washington, DC (USA). Apr 1989. 315p. Sponsored by Nuclear Regulatory Commission. (CONF-8810359–: Workshop on rules for exemption from regulatory control, Washington, D.C., USA, 17-19 Oct 1988). Available from NTIS, PC A14/MF A01 - GPO - OSTI.

This conference report documents the proceedings of an International Workshop on the subject of exempting radiation sources and practices from regulatory control. The purpose of the workshop was to provide national regulatory authorities an opportunity to exchange information on their respective approaches and practices involving exemptions and to enhance international understanding and cooperation on the derivation and practical application of the underlying principles. In addition, input from the workshop was intended to assist the NRC in the development of a policy statement on this issue. The workshop was divided into five sessions. During the first four sessions, papers were presented which defined the relative terms and concepts, outlined the national situations and approaches to the establishment and development of exemption rules, identified and discussed the existing issues, and gave the status of the international guidelines on exemption rules. The fifth session was devoted to summarizing the workshop and identifying the areas of consensus, the outstanding issues and the areas for future work. Individual papers were processed separately for the data base.

30635 (OEVS-Mitteilung–1988, pp. 10-22) **Ideas for a practice-oriented radiation protection law.** Kiefer, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In 1983, the directory of the Radiation Protection Professional Association (Fachverband fuer Strahlenschutz) of Germany, Austria and Switzerland entrusted a group of 7 experienced radiation protection specialists, among them the author, to elaborate the essentials of the radiation protection law. The results, intended as a basis for discussion, appeared as a paper in 1986. The broad chapters are: general regulations; radiation protection principles; radiation protection measures for professionally exposed persons; protection of the environment and of the population. Some points of this paper are expanded and discussed. 14 figs. (qui).

30636 (OEVS-Mitteilung–1988, pp. 23-27) **Legal aspects of justification and optimization in radiation protection.** Bischof, W. (Goettingen Univ. (Germany, F.R.). Abt. Atomenergierecht). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Review on the development of general principles recommended by the ICRP and the process of transformation of these principles into legal provisions of international governmental organizations and of the domestic law of the Federal Republic of Germany, Austria and Switzerland.

30637 (OEVS-Mitteilung–1988, pp. 33-38) **Development of Australian radiation protection regulations in the mining and milling of radioactive ores.** Koperski, J. (Ranger Uranium Mines, Jabiru (Australia)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Development of Australian radiation protection regulations in the uranium and sand mining and milling industries is described. Impact of environmental protection issues on regulation of uranium mining and milling industry is emphasized. 20 refs., 1 figs.

30638 (OEVS-Mitteilung–1988, pp. 64-69) **Enclosure of radioactive materials. Regulations, standards and practical experience.** Kowalewsky, H. (Bundesanstalt fuer Materialpruefung, Berlin (Germany, F.R.)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The author discusses his longstanding experience on prototype controlling of mailing parcels for transportation of radionuclides, nuclide batteries and ionization smoke monitors, and the pertaining standards. Emphasis is laid on fire-resistance tests. 5 refs., 1 fig., 7 tabs. (qui).

30639 (OEVS-Mitteilung–1988, pp. 187-192) **Radiation exposure of the public from operations of ranger uranium mines.** Koperski, J. (Ranger Uranium Mines, Jabiru (Australia)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The radiological impact on the public from the biggest uranium mining and milling operation in Australia is assessed. The aerial pathway appears to be the critical pathway for transfer of radioactive contaminants (radionuclides of U chain) from the ranger site to the local population. It is suggested that juveniles of the permanent Aboriginal community of the Manaburduma camp in Jabiru (7km wnw of the mine site) are most likely to form the critical group of the local population. The per capita average annual effective dose equivalent rate to this group is 0,25±0,10 from inhalation of long-lived activity attached to dust particles and 0,04±0,03 mSv/y (4±3 mWLM/y) from exposure to radon daughters. No evidence was found for an increase of exposure of the public due to consumption of bush food collected in the vicinity of the ranger site. It is concluded that the possible radiation exposure of the public, which could be attributed to the Company's present operations is one to two orders of magnitude below the limits set by the present Australian radiation protection legislation and several times below the 1 mSv/y limit recommended by ICRP and foreshadowed in the presently revised Australian legislation. 10 refs., 3 tabs.

30640 (SSI–87-11) **Land burial facility at the Forsmark plant. Inspection notes.** Bergman, C.; Ericsson, G.; Haegg, C. National Inst. of Radiation Protection, Stockholm (Sweden). 17 Mar 1987. 29p. (In Swedish). Order Number DE89614715/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report presents the formal background for the handling of the application for permission to build a plant for deposition of radioactive waste on land. The SSI (National Swedish Institute of Radiation Protection), basis for assessment are reported and relevant factors are presented. The radiation doses calculated by the SSI do not exceed a few stray microsievert per annum in spite of very pessimistical assumptions. The report constitutes assessment material for the standpoint to be taken by the SSI board. (L.F.).

30641 (SSI–87-26) **Disposal of radioactive waste in land burial facilities at Studsvik. Inspection notes.** Ericsson, G.; Haegg, C.; Bergman, C. National Inst. of Radiation Protection, Stockholm (Sweden). 17 Aug 1987. 22p. (In Swedish). Order Number DE89614716/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report presents the formal background for the handling of the Studsvik application for permission to build a plant for deposition of radioactive waste in land burial facilities. The SSI (National Swedish Institute of Radiation Protection) basis for assessment is reported and relevant factors are presented. The radiation doses calculated by the SSI do not exceed a few microsievert per annum in spite of very pessimistic assumptions. The report constitutes assessment material for the standpoint to be taken by the board of SSI. (L.F.).

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

30642 Continuously deformable mirrors. Sawicki, R.H. (Lawrence Livermore National Lab., Livermore, CA (US)); Sweatt, W. v.v of Electromechanical system interaction with optical design. Gowrinathan, S. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). (CONF-8705232–: Electromechanical system interaction with optical design, Orlando, Florida, USA, 21-22 May 1987).

Low spatial and temporal frequency correction of optical wavefronts can be achieved with continuously deformable mirrors that are being developed by the Atomic Vapor Laser Isotope Separation (AVLIS) Program at Lawrence Livermore National Laboratory. These devices are simple in design, low in cost, require relatively few actuators, and are capable of submicron deformation control using conventional stepper motors. The technique involves bending a mirror substrate with actuators that apply variable bending moments typically around the perimeter of the mirror. The location and orientation of these actuators and the thickness variation of the substrate determine the particular static shape that will be generated and the optical distortion that it can correct. For constant-thickness substrates the deformation will generally follow a curve that can be described by a quadratic function. However, by contouring the back surface of the substrate, higher-order deformations can be generated. Among the optical aberrations that can be generated by this technique are focus, astigmatism, coma, and spherical aberration. More complex shapes and other applications are being investigated. This method may also be useful in the manufacturing of aspherical optics.

0702 Radiation Sources

Refer also to citation(s) 31694, 31815

30643 (ANSTO/E–679) **Dosimetry and irradiation methods for the ANSTO gamma technology research irradiator (GATRI).** Izard, M.E. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Jul 1988. 14p. Order Number DE89616941/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The Australian Nuclear Science and Technology Organisation's gamma technology research irradiator (GATRI) at Lucas Heights, New South Wales, has been modified for use as a research and small-scale commercial irradiation facility to be available to government agencies and private industry for the technical and economic evaluation of irradiation processing. The new source rack was designed around existing mechanical components to optimise the limited space available within the irradiation cell. Irradiation parameters investigated during commissioning included the effect of source-to-target distance on relative dose rates within targets of the same density; effect of density on dose-rate distribution within targets irradiated at the same distance from the source; and the contribution of transit dose to low absorbed doses as the source is raised and lowered. The efficiency of the irradiator was determined for various target densities and overdose ratios.

30644 (CEA-CONF–9436) **Radiation disinfestation of stored cereals.** Boisseau, P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie. 1988. 2p. (In French). (CONF-880214–: Seminar for developing countries in Africa on food irradiation, Dakar, Senegal, 15-19 Feb 1988). Order Number DE89760706/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Post-harvest grain losses range world-wide between 5 and 10 percent and even 40 percent in some tropical areas where environmental conditions are favourable to cereal degradation. The grain losses during storage are of various origins: insects, microorganisms, rodents, birds. Their consequences on human health and cereal processing are of quantitative and qualitative nature.

30645 (CEA-CONF–9437) **Ionization technology.** Boisseau, P. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie. 1988. 3p. (In French). (CONF-880214–: Seminar for developing countries in Africa on food irradiation, Dakar, Senegal, 15-19 Feb 1988). Order Number DE89760707/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Ion formation in products exposed to ionizing radiations is used in some food industry applications, particularly for food conservation.

30646 (CONF-8810182–28) **Measurement and fitting of pulse shapes of moderators at IPNS [Intense Pulsed Neutron Source]: Progress report.** Bywater, R.L. Jr.; Williams, R.E.; Carpenter, J.M. Argonne National Lab., IL (USA). 1988. 22p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From International collaboration on advanced neutron sources (ICANS); Los Alamos, New Mexico, USA; 3-7 Oct 1988. Order Number DE89013624/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present a progress report on measurements and fitting of pulse shapes for neutrons emerging from one solid and two liquid methane moderators in IPNS. A time-focused crystal spectrometer arrangement was used with a cooled Ge monochromator. Data analysis of one of the liquid methane moderators has shown the need for some generalization of the Ikeda-Carpenter function that worked well for fitting pulse shapes of polyethylene moderators. We describe attempts to model physical insight into the wavelength dependence of function parameters. 5 refs., 7 figs.

30647 (INIS-BR–1458, pp. 204) **Some uses of radioisotope techniques in Portugal.** Salgado, J. (LNETI, Sacavem (Portugal). Dept. de Fisica); Carvalho, F.G.; Oliveira, C.; Ambrosio, A. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

RADIOISOTOPES/uses; COAL; HUMIDITY; INDUSTRY; PORTUGAL; RADIOISOTOPES; USES; SOILS; STEAM; SURFACE COATING

30648 (INIS-mf–11424) **Radiometric weighing devices. Part 1 and 2. Fundamentals, design, and applications.** Arbeiten zur Mechanisierung der Pflanzen- und Tierproduktion. v. 5(2). Glaeser, M. Akademie der Landwirtschaftswissenschaften der DDR, Schlieben-Bornim (German Democratic Republic). Forschungszentrum fuer Mechanisierung der Landwirtschaft. Mar 1985. 206p. (In German). Order Number DE89614199/JAW. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Arbeiten zur Mechanisierung der Pflanzen- und Tierproduktion.; v. 5(2).

Proceeding from the physical and mathematical fundamentals and from the types of radiometric weighing devices presently available, the radiation protection problems arising from the application of radiometric gages in industry and agriculture are discussed. Nuclear weighing devices have been found to be effective from economic point of view but in some cases gravimetric conveyor weighers are indispensable. Information and guidance is given especially for users of radiometric weighing devices. 91 refs., 69 figs., and 8 tabs.

30649 (OEVS-Mitteilung–1988, pp. 70-72) **Calculation of requirements respectively of radiation protection as condition for the permission of medical X-ray plants.** Nell, M. (Pruefanstalt fuer Radiologie und Elektromedizin, Vienna (Austria)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The results of radiation measurements are more or less diverging from the results of the calculation, performed before setting up the plant. There is at least in Austria a tendency to give much greater importance to the results of the measurement. The possible uncertainties of calculating protective layers are explained. A survey is given over the most frequent errors resulting even from the correct use and especially from the misuse of the measurement-instrumentation. So a result of a radiation measurement should not be the only argument for the authority to validate radiation protection precautions. 7 refs.

08 HYDROGEN

0801 Production

Refer also to citation(s) 30267, 30396

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

Refer also to citation(s) 30264, 30297, 30372, 30702, 30703, 31040, 31046, 31436, 31470

30650 (DOE/PC/88861–T16) **Metallic glasses as selective catalysts for synthesis of hydrocarbon liquids in high sulfur conditions: Final report, January 1–December 31, 1988.** Brower, W.E. Jr. Southern Illinois Univ., Carbondale, IL (USA). Apr 1989. 25p. Sponsored by DOE Fossil Energy. DOE Contract FC22-88PC88861. Order Number DE89012695/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Unusual selectivities for higher hydrocarbon formation were observed over $Fe_{80}B_{20}$ glassy catalysts in the Fischer-Tropsch reaction. However, these selectivities were very short lived and correlated with crystallization of the near surface region of the metastable glass during reaction conditions. 9 refs., 5 figs., 8 tabs.

30651 (PB–89-165377/XAB) **Methane from partially digested sewage sludge. Final report.** Friedman, A.A.; Smith, J.E. Syracuse Univ., NY (USA). Apr 1987. 172p. Available from NTIS, PC A08/MF A01.

This report describes one of two laboratory research projects designed to explore the possibility of recovering a usable fuel from digested sludge. The process studied involved first heating partially digested sludge (PDS) to temperatures between 140 and 270°C for different retention times and then anaerobically digesting the supernatant after the treated material settled. Two anaerobic digester designs were tested: a rotating biological contractor and an immobilized cell reactor. These digesters were operated at 35 and 55 degrees C, respectively. The report also includes an analysis of the capital and operating costs of this methane-from-PDS process and describes the character of the residues produced.

30652 (PB–89-178180/XAB) **Trace constituents in landfill gas. Task report on corrosion potential. Final report, May 1984-June 1985.** Chakravarti, B. SCS Engineers, Inc., Covington, KY (USA). Mar 1988. 37p. Available from NTIS, PC A03/MF A01.

See also PB–88-217013.

This report presents the results of a task performed for the Gas Research Institute (GRI) program entitled 'Evaluation of Gas Cleaning Technologies for Trace Constituent Removal'. The report summarizes work performed under Task I-1 of that program: 'Corrosion Potential of Trace Constituents in Landfill Gas'. Trace

compounds present in landfill gas (LFG) were categorized into one of eight groups based on chemical characteristics. A method was then developed to identify those compounds which have a high probability of being present in cleaned-product landfill gas. The corrosion potential for each group was evaluated qualitatively for its influence on pipeline materials and residential and industrial appliances, equipment, and facilities. Most gas-treating plants for landfill gas remove the bulk of corrosive constituents before product LFG is added to the pipeline. Thus, the corrosion potential from cleaned gas is minimal.

30653 Treatment of synthetic crudes with metal chlorides and metal carbonyls. Dymock, K.R. (Petro-Canada Products, Ontario (Canada)); Sawatzky, H. *Separation Science and Technology (USA)*, 23(12,13): 2087-2095 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The removal of problematic synthetic crude compounds with limited amounts of transition metal chlorides, carbonyls and hydrido carbonyls was investigated. A middle distillate fraction containing pure compounds of nitrogen and sulfur that are typical of this fraction was used. Chlorides of copper, iron, tin and zinc showed significant potential for removal of the nitrogen compounds and ethyl and phenyl mercuric chlorides reacted with these compounds at 200°C. These chlorides reacted with mercaptans and alkyl sulfides to varying degrees and with the exception of ethyl mercuric chloride had little effect on benzo and dibenzothiophene. However, the carbonyls of cobalt and manganese were quite promising for these techniques. Hydrido carbonyls of these metals were more favorable for the nitrogen compounds. There is evidence of competition for sites on the solid metal salts.

0902 Alcohol Fuels

Refer also to citation(s) 31040, 31154

30654 (CONF-890177–2) **Identification and evaluation of SERI-NF1 fungus for ethanol production from xylose fermentation.** Antonopoulos, A.A. Argonne National Lab., IL (USA). Jan 1989. 6p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Ethanol from biomass annual review meeting; Golden, Colorado, USA; 17-19 Jan 1989. Order Number DE89013642/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This work aimed at identifying the SERI-NF1 fungus isolated by Solar Energy Research Institute investigators, as well as evaluating the fungus as an ethanol producer from xylose fermentations. Microscopic and physiological observations led to the conclusion that the fungus is Paecilomyces varioti Bainier 1907. The fungus grows relatively fast in PDA plates, and its cultures release a light sweet aromatic odor. In liquid cultures the fungus forms round mycelial balls (1–12 mm in diameter). It showed to be thermophilic (grown well at 26–36°C) and thermotolerant (exposed for two hours to 60°C resumed its growth), and to prefer pH levels close to neutrality. Cultures of the fungus were tested (in 125 ml flasks) for fermenting xylose to ethanol. Its growth in the liquid cultures was slow and formed mycelial balls. The yield of ethanol production was low. The amount of fungal mass has to be more than a few mycelial balls per flask to get a reasonable yield of ethanol. 17 refs., 1 fig.

30655 (SERI/SP–231-3245, pp. 1-22) **Ethanol from lignocellulose: the DOE/SERI Biochemical Conversion/Alcohol Fuels Program.** Wright, J.D. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Ethanol, a high octane liquid fuel compatible with today's transportation system, can be produced by biological processes from lignocellulosic feedstocks. Biomass is an attractive feedstock for ethanol production because it is available in large quantities at low cost. The chief advantage of biological processes is that they have the potential to convert wood to liquid fuels with an efficiency approaching 100%. However, in order to achieve this, each fraction of the lignocellulosic feedstock must be processed separately. The Biochemical Conversion/Alcohol Fuels Research Program managed by the Solar Energy Research Institute (SERI) for the US Department of Energy's Biofuels and Municipal Waste Technology Division carries out a program of research and development with the goals of developing processes for converting lignocellulosic materials to ethanol and other fuels in an efficient and cost-effective manner, and facilitating the adoption of these processes by industry. This annual report for fiscal year 1987 summarizes the state of the art and the research conducted by the Biochemical Conversion/Alcohol Fuels Research Program in the past year. The appendices contain detailed descriptions of the individual projects.

30656 (SERI/SP–231-3245 A.1-A.19) **Overview of acid hydrolysis of lignocellulosics to liquid fuels.** Wright, J.D.; Wyman, C.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

In this paper, an overview is presented of acid hydrolysis processes for conversion of lignocellulosic biomass into ethanol. First, biomass composition and acid hydrolysis kinetics are briefly reviewed to establish the limitations on acid catalyzed breakdown of cellulose and hemicellulose. Then, process descriptions are summarized for six acid catalyzed processes: The plug flow reactor, the percolation reactor, the progressing batch reactor, the low temperature concentrated sulfuric acid process, liquid phase hydrochloric acid hydrolysis, and liquid phase hydrofluoric acid hydrolysis. A summary of the economics of each option are presented along with projections of cost improvements that may be possible. Based on these considerations and the need to focus R&D on a few, promising options, the plug flow and progressing batch dilute acid hydrolysis processes are selected for engineering research at SERI, while the Tennessee Valley Authority (TVA) is pursuing the concentrated sulfuric acid hydrolysis process.

30657 (SERI/SP–231-3245 A.20-A.32) **Dilute acid hydrolysis of high solids woods slurries in a two-stage continuous flow process.** Brennan, A.; Schell, D.; Hoagland, W.; Werdene, P. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Research in SERI's Biotechnology Branch has addressed the technical feasibility of pumping high-solids wood slurries (>18%) in a continuous two-stage acid hydrolysis process. The research was intended to resolve a primary uncertainty in the potential of the technology to produce fermentable sugars for fuel-grade ethanol. The approach of the experiments was to prehydrolyze the wood at mild conditions prior to the hydrolysis reactor, thereby degrading the hemicellulose. The resultant prehydrolyzate slurry resists the plugging, dewatering and bridging typical of water-wood mixtures and can be pumped more easily at relatively high concentrations. The SERI experiments encountered several major equipment problems that delayed progress. Problems with the automatic wood feeder and the airlock hopper were resolved, but problems with the Moyno progressing cavity pump remain. The pump problems prevented sufficient operation to demonstrate pumpability of the high solids slurries. However, the authors believe that some limited additional testing with a new Moyno pump would provide sufficient data to successfully demonstrate the process. Currently, work is being continued with funding by a private company that is interested in commercializing the process for the production of specialty chemicals.

30658 (SERI/SP–231-3245 A.33-A.43) **Fermentability tests of sugars produced in the Solar Energy Research Institute's plug-flow reactor.** Beck, M.J. (Tennessee Valley Authority, Muscle Shoals, AL (USA)). Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

An experiment was designed to determine the relative fermentability of hydrolyzates produced in the Solar Energy Research Institute's (SERI) plug-flow reactor. Two hydrolyzates were prepared for fermentability testing by raising the pH to 5.5 with calcium oxide (CaO) or overneutralizing with CaO, filtering, and adding sulfuric acid (H_2SO_4) to reach pH 5.5 Prepared hydrolyzates were tested at

full, half, and quarter strength. Test solutions were inoculated with Saccharomyces cerevisiae, S. uvarum, or a coculture of Candida lusitaniae and Candida sp. Half- and quarter-strength hydrolyzates proved fermentable by the individual yeasts and the coculture without regard for the type of preparation for fermentability testing. Conversion efficiencies were 0.45 g ethanol/g glucose or better. Full-strength hydrolyzates were not fermented using S. uvarum. Overneutralization greatly improved fermentation of full-strength hydrolyzates using S. cerevisiae and the coculture. A slightly better ethanol yield was achieved in the hydrolyzate with the greater amount of glucose. Fermentability test results have implications for means to recover near-theoretical yields of ethanol from hydrolyzates produced in the plug-flow reactor.

30659 (SERI/SP–231-3245 A.55-A.64) **Packed bed hydrodynamics of an acid hydrolysis percolation reactor.** Calo, J.M. (Brown Univ., Providence, RI (USA)); Hradil, G. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

This project is concerned with an experimental and analytical study to develop a predictive model for acid hydrolysis percolation reactors of the type being considered by SERI for conversion of lignocellulosic materials to fuel ethanol. The modeling approach proposed is an adaptation of stochastic percolation theory to the wood chip bed. Essentially, the theory provides for the volume-averaging of random local hydrodynamic phenomena on the particle scale, to the bed scale. The experimental work will be accomplished primarily in a 6-inch diameter reactor of the type currently in use at SERI, on loan to Brown University for the duration of the contract. The reactor has been received and is currently in the process of installation at Brown. This reactor will be used for both wood chip conversion and inert tracer studies of liquid holdup, an indicator of liquid-solid contacting. The latter data are needed for the development of the percolation model. In addition to providing a convenient, nondisruptive method for measuring liquid holdup, the tracer data can also be interpreted to yield the effective intraparticle diffusivity in the wood chips. One important aspect of the experimental work involves characterization of the wood chips as a function of conversion. Work along these lines thus far has shown that both flow BET (N_2 and CO_2) and mercury intrusion porosimetry are not suitable for characterizing the internal structure of the aspen wood chips. However, monolayer adsorption of cationic dyes has been shown to yield reasonable and reproducible results for internal surface areas. Following the experimental and theoretical work at Brown University, the resultant hydrodynamic reactor model will be tested for predictive capability on the SERI PBR system.

30660 (SERI/SP–231-3245 A.65-A.73) **Ethanol from cellulosic residues and crops.** Moore, M.R. (Tennessee Valley Authority, Muscle Shoals, AL (USA)); Barrier, J.W. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The Tennessee Valley Authority, in cooperation with the US Department of Energy (DOE) and the Solar Energy Research Institute (SERI), is developing concentrated acid hydrolysis technology for producing fuel-grade ethanol from agricultural cellulosic materials. The low-temperature, low-pressure, concentrated acid hydrolysis process developed by TVA has been evaluated in a 4-t/d-of-feedstock experimental facility (1984 to 1986) using corn stover feedstock. Hemicellulose and cellulose conversion efficiencies over 90 percent were achieved. Several process optimization and acid recovery studies are being conducted to decrease acid requirements and improve the overall efficiency of the process. Hydrolysis processing options evaluated and discussed in this paper include hydrolyzate recycle, high-pressure pressing, high-intensity mixing, and microwave and radio-frequency drying. Acid recovery research results are given in the areas of adsorption, solvent extraction, and ion exchange.

30661 (SERI/SP–231-3245 A.74-A.84) **Acid recovery of polyamine.** Tsao, G.T. (Purdue Univ., West Lafayette, IN (USA)). Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Acid hydrolysis of cellulosics will result in solutions of glucose and xylose contaminated by the acid. Neutralization with lime will remove most of the sulfuric acid in the form of precipitated gypsum but a sufficient amount of calcium ions will remain in the solution. The calcium ions are inhibitory towards xylose isomerase enzyme which is sometimes employed to convert xylose to xylulose to be fermented to ethanol. Removal of the acid catalysis by a solid resin adsorbent will therefore help to avoid this problem of inhibition. A class of polymers (PA-polyamine) have been used to remove acids from the sugar solution.

30662 (SERI/SP–231-3245 A.85-A.94) **Concentrated acid hydrolysis with acid recovery.** Prieto, S. (Univ. of Arkansas, Fayetteville (USA)); Clausen, E.C.; Gaddy, J.L. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Agricultural residues such as corn stover are available annually in quantities of 300 tons/yr and could supply the raw materials for all this nation's petrochemical production. Lignocellulosic residues can be converted efficiently with mineral acids to sugars which can be fermented to a wide range of fuels and chemicals, such as ethanol, organic acids, acetone, etc. The economic success of acid hydrolysis technology depends upon process conditions that maximize yields and minimize energy and equipment costs. Acid recovery is essential to the economic viability of concentrated acid processes. This paper describes a process to produce sugars from lignocellulosic materials using a simple single stage conversion that requires mild operating temperatures and short reaction times. A process scheme for acid recovery is presented. Material and energy balances for hydrolysis and acid recovery are discussed.

30663 (SERI/SP–231-3245 B.1-B.12) **Overview of enzymatic hydrolysis research.** Wright, J.D. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

A successful process for converting lignocellulose to liquid fuels must make use of all of the three major components of the feedstock (cellulose, xylan from the hemicellulose, and lignin), plus most of the minor constituents as well (organic acids and extractives). Because cellulose is generally the largest fraction and because the process used for the hydrolysis of cellulose affects all the other utilization processes, research on hydrolysis processes are the central component of the Biochemical Conversion/Alcohol Fuels Research Program. Of all the parameters which may be used to describe a process, yield and product concentration are the most important. Therefore, because enzymatic hydrolysis with fungal enzymes holds the promise for the high yields and ethanol concentrations, as well as low capital and operating costs, enzymatic hydrolysis is our chief focus. All enzymatic processes for the utilization of cellulose have four major components pretreatment, hydrolysis, fermentation, and enzyme production. The research carried out in each of these areas, as well as its rationale, is described in this section.

30664 (SERI/SP–231-3245 B.130-B.139) **Integrated process for production of ethanol.** Beck, S.R. (Texas Tech Univ., Lubbock (USA)); Schoenrock, J. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Although many processes for production of ethanol from lignocellulosic materials have been proposed during the last thirty years, there are no processes that appear to be competitive from an economic standpoint at this time. Major problems are in the areas of hydrolysis of cellulose to fermentable sugars, ethanol inhibition during fermentation, recovery of anhydrous ethanol, and recovery and recycle of active yeast and enzymes. In July, 1987, a project was initiated at Texas Tech under subcontract to the Solar Energy Research Institute, to address this last problem, namely that of recovery of active yeast and cellulase from the fermenter effluent in a SSF process. Four major tasks will be performed under this subcontract. First a thorough literature review will be conducted to identify as many possible methods for achieving the desired separation as

possible. Following this, a series of preliminary experiments will be conducted to obtain physical as well as chemical properties of the yeast-enzyme-cellulose system. These data will be used to propose a separation scheme which will be studied in the fourth phase of the project through extensive experimental studies and modeling of the process. The current status is that the literature review is nearly complete and key process variables have been identified for the experimental phase of the work. The preliminary research plan and direction is reported in this review although the exact plan has not been completed at this time. The research will focus on factors which affect the adsorption/desorption of cellulase and its individual components in the presence of crystalline cellulose.

30665 (SERI/SP–231-3245 B.140-B.164) **Economic evaluation of pretreatment and non-pretreatment vendor size tests and costs for commercialization of the continuous enzymatic SSF for production of ethanol from cellulose waste.** Richerson, F.B. (CADCO, Incorporated, Petersburg, VA (USA)). Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

A process, owned by the University of Arkansas and called the UA process, biologically converts cellulosic materials (such as RDF) into ethanol. This process has been technically proven in both bench-scale tests and a 1 ton per day pilot plant, and now the UA process needs to be further developed so it can be commercially integrated into an overall waste-to-energy plant which converts raw MSW into recyclable fractions (ferrous, glass, and aluminum), power, ethanol, and an animal feed co-product. A 3-Phased program has been prepared by CADCO, Inc. to advance this process to the stage at which a commercial plant could be constructed and venture financing secured without burdening investors with unreasonable risk. A $677,000 contract was awarded by SERI to CADCO, Inc., to carry our Phase I. The Phase I scope of work has now been completed and the economics look sufficiently attractive which justifies progressing this technology to the Phase II program. Commercial development of the UA process will provide a new competitive source of ethanol; a system for economically converting serious waste disposal problems into liquid fuel energy and recyclable co-products.

30666 (SERI/SP–231-3245 B.77-B.92) **Organosolv pretreatment.** Black, S.; Johnson, D.K.; Chum, H.L. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The objective of this task is to explore organosolv pretreatment as an option for fractionation of all biomass components for the conversion of biomass into liquid fuels. Conditions optimal for pulp production differ substantially from those needed to produce digestible cellulosic materials. This report summarizes work carried out in collaboration with several researchers. The areas addressed are: (1) Evaluation of enzyme hydrolysis or organosolv cellulosic residues produced in a batch mode. These studies indicated that the cellulosic residues need to contain less than 13% xylan for high digestibility to be realized; similar trends have been observed with dilute acid hydrolysis and steam explosion. This content corresponds roughly to removal of 50% of the original xylan. The kinetics of enzyme hydrolysis is described phenomenologically as composed to two simultaneous pseudo-first order reactions in which fast and slow hydrolyses of cellulose occur. The ratio of fast to slow rate constants is roughly 10. The higher severity pretreatments produced a higher amount of fast hydrolyzable cellulosic resides. (2) Construction and testing of a flow-through delignification reactor for comparative studies between batch and semi-continuous mode of operation and kinetic studies. (3) The evaluation of sulfur dioxide as catalyst for organosolv pretreatment. An empirical model of the effects of process conditions on total hexosan retention, pentosan and lignin removal has been made for birch. Experimental work will continue with Populus species, and other feedstocks of interest to the short-rotation production program managed by ORNL.

30667 (SERI/SP–231-3245 B.93-B.106) **Simultaneous saccharification and fermentation of cellulose and wheat straw to ethanol: evaluation of thermotolerant yeast and B-glucosidase supplementation.** Spindler, D.D.; Grohmann, K.; Wyman, C.E.; Mohagheghi, A. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

From preliminary glucose and simultaneous saccharification and fermentation (SSF) screening test of 10 promising microbial strains at temperatures ranging (37 to 47°C), five yeast, Saccharomyces cerevisiae, S. uvarum, Candida lusitaniae, C. brassicae, and Brettanomyces, clausenii, were selected as good fermenters in pure or mixed culture for more detailed evaluations. The parameters measured included ethanol concentration, yeast cell density, residual sugars, and cellulose concentration. Mixed cultures of S. cerevisiae with B. clausenii and C. lusitaniae with S. uvarum fermented best on Sigmacell-50 cellulose substrate, apparently because of rapid cellobiose removal. However, for pretreated wheat straw, SSF with a single culture of a strong glucose-fermenting ethanol-tolerant yeast achieved higher conversion rates and yields than the mixed culture if the cellulose enzyme was supplemented with B-glucosidase. Enzyme supplementation alleviates possible problems of mixed culture maintenance, which may arise in continuous fermentations.

30668 (SERI/SP–231-3245 C.1-C.10) **Xylose fermentation analysis.** Hinman, N.D.; Wright, J.D.; Hoagland, W.; Wyman, C.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Development of a process to convert xylose to ethanol will significantly improve the economics for biochemical conversion of lignocellulosic resources to liquid fuels. The industrial yeasts currently used to ferment glucose to ethanol are unable to ferment xylose. However, alternate yeast strains, bacteria, fungi, and a xylose isomerase-yeast combination have been identified which can carry out this conversion. In this paper, the authors examined the conversion of xylose to ethanol and the effects of key process variables associated with xylose conversion on the overall economics of a wood-to-ethanol plant. For the plant design considered, the maximum potential reduction in the price of ethanol derived from utilization of xylose was $0.42 per gallon from a base case price of $1.65 per gallon. The current performances of several yeasts, fungi, bacteria, and a xylose isomerase-yeast combination were examined. P. stipitis or C. shehatae appear to be capable of reducing the ethanol cost by $0.29 per gallon, or 70% of the maximum potential reduction. To equal this performance, other types of biocatalysts must have a xylose to ethanol yield of 70% and be capable of producing ethanol at a concentration greater than 2 to 2.5%. With this bench mark established, future work in biocatalysts development should be centered on those biocatalysts which show promise of significantly exceeding this mark.

30669 (SERI/SP–231-3245 C.11-C.23) **Simultaneous fermentation and isomerization of xylose to ethanol.** Lastick, S.; Tucker, M.Y.; Grohmann, K. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Xylose was fermented anaerobically to ethanol by combining the enzyme, xylose isomerase, with the yeast Schizosaccharomyces pombe in pH, and temperature controlled fermenters. The effects of media composition, temperature, pH and enzyme loading were examined. Significant improvement (15 to 30%) in ethanol yields were found when the fermentations were run at lower temperatures (28°C) and at lowest pH that allowed for reasonable enzyme activity (pH 5.5). Since fermentation at low pH is necessary for high yields, recombinant E. coli cells containing overproduced xylose isomerase were immobilized in a chitosan matrix to provide for high activity at low pH; the immobilized cells were found to have four times the specific activity at pH 5.5 than non-immobilized cells, and an estimated 40 times the activity of non-recombinant, xylose, induced cells.

30670 (SERI/SP–231-3245 C.40-C.50) **Comparison of Saccharomyces cerevisiae and Candida shehatae for bioconversion of corn stover hydrolyzate to ethanol.** Beck, M.J. (Tennessee Valley Authority, Muscle Shoals, AL (USA)). Solar Energy Research

Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

An experiment was designed to determine the effects of the sugar composition and concentration of a corn stover hydrolyzate on ethanol production using Saccharomyces cerevisiae and Candida shehatae for comparison. The corn stover hydrolyzate was produced by means of concentrated acid hydrolysis. The concentration of sugars was 110 g/L. The sugars were composed of 59 percent glucose, 30 percent xylose, and 11 percent other sugars. The yeasts were tested at two levels of inoculum and at two levels of nutrient supplementation (a standard level and an enriched level). An evaluation was made to determine any additive effects of ethanol accumulation resulting from metabolism of the medium from inoculum preparation or from the nutrient supplements in the bioconversion. The ethanol yield was the same from the corn stover hydrolyzate using S. cerevisiae and C. shehatae. A greater inoculum level resulted in an increased rate of ethanol production for C. shehatae but not for S. cerevisiae. Enriched nutrients were not superior to standard nutrients for ethanol yields from xylose. No advantage was gained from bioconversion using the xylose fermenter, C. shehatae. The results of bioconversion using C. shehatae were consistent with previous experience with Pachysolen tannophilus. No ethanol was attributable to the bioconversion of xylose. Xylitol accumulated in the bioconversions. A detectable amount of ethanol was carried over into the fermentation with the larger inoculum. A detectable amount of ethanol resulted from the enriched nutrient supplement as a substrate for bioconversion.

30671 (SERI/SP–231-3245 C.51-C.60) **Fusarium strain development and selection for enhancement of ethanol production.** Antonopoulos, A.A. (Argonne National Lab., IL (USA)); Wene, E.G. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Research data obtained at Argonne National Laboratory indicates that selected Fusarium strain isolated from natural habitats are potential decomposers and fermenters of biomass. The amount of ethanol produced is comparable to that yielded by other potential microorganisms and, moreover, Fusarium strains can ferment xylose (pentoses) while other microbes cannot. Preliminary mutagenesis studies on Fusarium isolates indicates that potential mutants can be developed which are capable of hydrolyzing more cellulosics in a shorter time as well as fermenting monosugars to ethanol at higher rates than their parental wild strains. Therefore, new studies were initiated to further enhance the ethanol production via Fusarium genetic manipulation. In particular, the aim of this task is to develop superior Fusarium strains capable of fermenting monosaccharides (specifically xylose) to ethanol, and able to tolerate higher ethanol concentrations than selected wild strains. Experimental work on hyphal fusions of selected Fusarium strains with the purpose of exploiting heterokaryosis and parasexuality for the development of new superior strains has been initiated. Bibliographic information related to Fusarium genetics and ethanol fermentation has been studied and a summary is presented.

0904 Solid Waste and Wood Fuels

Refer also to citation(s) 30703, 30801, 30984, 31040, 31914

30672 (DOE/OR/21389–16) **Northeast Regional Biomass Energy Program: Progress report, January 1989–March 1989.** O'Connell, R. CONEG Policy Research Center, Inc., Washington, DC (USA). Apr 1989. 12p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21389. Order Number DE89012956/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Program conducted by NRBP has three basic features: (1) a state grant component that provides funds (with a 50 percent matching requirement) to each of the state agencies involved in biomass energy; (2) a series of technical reports and studies in areas that have been identified as being of critical importance to the development of biomass energy in the region; and (3) a continuous long range planning component with heavy private sector involvement that helps to identify activities necessary to spur greater development and use of biomass energy in the Northeast. The state grant program provides states with an opportunity to strengthen and integrate the work of energy, forestry, air quality. Until recently, most state efforts to promote biomass involved various aspects of this energy source. The state grant projects required interagency cooperation and fall into several general categories: industrial conversion assistance; resource availability and use assessments; technical information development and dissemination; and conversion of state facilities.

30673 (NME–1986) **Large scale wood heating.** Mercy Hospital and Medical Center, Chicago, IL (USA). 1986. 11p. (MICROLOG–89-01937). Available from Dept. of Mines and Energy, PO Box 4750, St. John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report lists operating woodchip heating systems in Newfoundland in 1986 ranging from 0.4 to 13 MW. Woodchips provide energy at 1/2 or 2/3 of the cost of oil. The chips are burnt green and fed automatically. The report discusses sources of woodchips, burning systems, and calorific value and cost as compared to oil. 4 figs., 2 tabs.

30674 (ORNL–6404) **Construction of a simplified wood gas generator for fueling internal combustion engines in a petroleum emergency.** LaFontaine, H.; Zimmerman, G.P. Oak Ridge National Lab., TN (USA). Mar 1989. 72p. DOE Contract AC05-84OR21400. Order Number DE89012903/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report is one in a series of emergency technology assessments sponsored by the Federal Emergency Management Agency (FEMA). The purpose of this report is to develop detailed, illustrated instructions for the fabrication, installation, and operation of a biomass gasifier unit (i.e., a "producer gas" generator, also called a "wood gas" generator) that is capable of providing emergency fuel for vehicles, such as tractors and trucks, in the event that normal petroleum sources were severely disrupted for an extended period of time. These instructions have been prepared as a manual for use by any mechanic who is reasonably proficient in metal fabrication or engine repair. This report attempts to preserve the knowledge about wood gasification that was put into practical use during World War II. Detailed, step-by-step fabrication procedures are presented for a simplified version of the World War II, Imbert wood gas generator. This simple, stratified, downdraft gasifier unit can be constructed from materials that would be widely available in the United States in a prolonged petroleum crisis. For example, the body of the unit consists of a galvanized metal garbage can atop a small metal drum; common plumbing fittings throughout; and a large, stainless steel mixing bowl for the grate. The entire compact unit was mounted onto the front of a farm tractor and successfully field tested, using wood chips as the only fuel. Photographic documentation of the actual assembly of the unit as well as its operation is included. 19 refs., 39 figs., 6 tabs.

30675 (STEV-TB–89-2) **Task report: Stockholm no 1564/881110. Technique - Fuel preparation.** Jansson, Aa.; Sandqvist, I. Statens Energiverk, Stockholm (Sweden). Nov 1988. 15p. (In Swedish). Order Number DE89766886/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

It is possible to obtain certain improvements when mixing polyethene into the briquets made of wood waste. The briquets have improved dimensional stability and reduced risk of going mouldy. The energy content is high and the fuel is easy to burn and the flue gas is less polluting because of low water content. (G.B.).

0905 Liquid Waste Fuels

Refer also to citation(s) 30703

0906 Gaseous Waste Fuels

Refer also to citation(s) 30703

13 HYDRO ENERGY

30676 (OME–1988) **Small hydro '88. An international conference and trade show. Proceedings, vol. 1.** Ontario Ministry of Energy, Toronto, ON (Canada). 1988. vp. (CONF-880711–: Small hydro '88: international conference and trade show, Toronto, Canada, 4-9 Jul 1988;MICROLOG–89-02657;CE–02580). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CA.

This congress describes the development and prospects of small-scale hydroelectric power plants, both in Canada and the world, expecially developing countries. The authors discuss available sites, design problems (in particular the need for standardization), environmental impacts, and the problems associated with new laws and regulations. Numerous realizations are presented both in Canada and in developing countries (Pakistan, Columbia), both on-grid and off-grid. The policies of utilities and governments (Canada, Algeria) with respect to small hydro power plants are also presented, as are the social and economic impacts of the electrification of remote areas. Twenty-six papers have been abstracted.

1303 Plant Design and Operation

30677 (PB–89-162044/XAB) **Report on modular hydropower demonstration.** Pelton, F. Acres International Corp., Amherst, NY (USA). Sep 1988. 109p. Available from NTIS, PC A06/MF A01.

This report describes an Energy Authority project to demonstrate the use of modular small hydropower systems at two sites. The project demonstrated that 'off-the-shelf' components can be used to construct a functionally reliable, cost-effective hydropower system at a significant savings over custom-designed systems. A key feature of the modular system is the replacement of the conventional hydroelectric turbine with a pump operated in reverse. Also, the construction of a water-intake system in the dam is replaced with a siphon penstock. Further cost and time savings are gained from the use of a prefabricated powerhouse and automated control equipment. The project demonstrated that modular systems are an attractive option for sites with capacities from under 100 to 500 kilowatts. The modular concept is applicable at about 250 sites Statewide, with a combined capacity of up to 400 MW.

1306 Environmental Aspects

30678 (BCH/RLM–8810) **Recreation opportunities inventory.** British Columbia Hydro, Vancouver, BC (Canada). Recreation Land Management. 1988. 186p. (MICROLOG–89-01781). Available from British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

At the request of B.C. Hydro's Board of Directors, a review of all Hydro's reservoirs was undertaken to inventory ways by which recreation use of these resources could be facilitated. The findings are rated and presented in tabular form. The table indicates that each region of the province has projects that could provide moderate, or better, opportunities for enhancing recreational use. Good opportunity ratings were assigned to three projects in the South Interior Region, three in the Lower Mainland Region, and one on Vancouver Island. For the province as a whole, 23 projects have moderate to good prospects for supporting further recreational development and use. Eleven projects, or about 1/4 of the total, have at least a moderate capability for further development in a broad range of recreational activities. Of these, seven projects appear to present good, or excellent, opportunities for recreational enhancement. 42 figs.

30679 (DOE/BP/22493–4) **Kokanee stock status and contribution Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho: Annual progress report FY 1988.** Bowles, E.C.; Ellis, V.L.; Hoelscher, B. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Idaho Dept. of Fish and Game, Boise, ID (USA). Fisheries Research Section. Feb 1989. 60p. Sponsored by DOE Environment Health & Safety. DOE Contract AI79-85BP22493. Order Number DE89013039/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The kokanee Oncorhynchus nerka rehabilitation program for Lake Pend Oreille continued to show progress during 1988. Estimated kokanee abundance in early September was 10.2 million fish. This estimate is 70% higher than 1987 and 140% higher than the populations's low point in 1986. Increased population size over the past two years is the result of two consecutive strong year classes produced from high recruitment of hatchery and wild fry. High recruitment of wild fry in 1988 resulted from good parental escapement (strong year class) in 1987 and relatively high fry survival. Hatchery fry made up 51% of total fry recruitment (73% of total fry biomass), which is the largest contribution since hatchery supplementation began in the 1970s. High hatchery fry abundance resulted from a large release (13 million fry) from Cabinet Gorge Hatchery and excellent fry survival (29%) during their first summer in Lake Pend Oreille. Improved fry release strategies enhanced survival, which doubled from 1987 to 1988 and was ten times higher than survival in 1986. Our research goal is to maintain 30% survival so we are very optimistic, but need to replicate additional years to address annual variability. 27 refs., 24 figs., 3 tabs.

30680 (DOE/BP/34796–4, pp. 13-55) **Predation by northern squawfish, walleye, smallmouth bass, and channel catfish in a mainstem Columbia River reservoir. I. Feeding ecology during the salmonid smolt out-migration.** Poe, T.P.; Hansel, H.C.; Vigg, S.; Palmer, D.E.; Prendergast, L.A. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

Diets of northern squawfish (Ptychocheilus oregonensis), smallmouth bass (Micropterus dolomieui), walleye (Stizostedion vitreum vitreum), and channel catfish (Ictalurus punctatus) from John Day Reservoir were examined to determine the extent of predation on juvenile salmonids during their seaward migration (April-August) 1983-1986. Pacific salmon (Oncorhynchus spp.) and steelhead (Salmo gairdneri) juveniles were the most important food group for northern squawfish – 66.7% by weight, but comprised a lesser gravimetric proportion for other predators: catfish (32.9%), walleye (13.5%), and smallmouth bass (3.7%). Ivlev's electivity index (Ei) indicated that northern squawfish preferred smolts during May and August, generally their peak out-migrations, and switched to prickly sculpins (Cottus asper) when smolt number declined. Walleye and smallmouth bass showed preference only for prickly sculpin of all prey fishes tested.

30681 (DOE/BP/34796–4, pp. 56-115) **Predation by resident fish on juvenile salmonids in a mainstem Columbia River Reservoir: Part II. Consumption rates of northern squawfish, walleye, smallmouth bass, and channel catfish.** Vigg, S.; Poe, T.P.; Prendergast, L.A.; Hansel, H.C. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

Trends of consumption rates of four fish predators in John Day Reservoir were modeling in order to evaluate their impact on seaward migrating juvenile salmonids. Northern squawfish are the most important predator on juvenile salmonids in John Day Reservoir in terms of their spatial, temporal, and size-related consumption rates. Prey density, thermal relations, and spawning activity are important factors affecting predator consumption rates. The thermal regime in John Day Reservoir is probably near optimum for northern squawfish consumption, and below optimum for the other predators. Optimum temperatures of the predators are approximately: northern squawfish, 20°C; walleye, 22.6°C; smallmouth bass, 28°C; and channel catfish, 30°C. The total daily ration determined for predators in John Day Reservoir are consistent with the knowledge of physiological requirements, and similar studies of piscivores in other habitats. In consideration of the seasonal, areal, diel, and predator size-related trends in consumption rates, in conjunction with the

characteristics of the smolt out-migration – several management actions to lessen losses of juvenile salmonids to fish predation in John Day Reservoir are feasible.

30682 (DOE/BP/34796–4, pp. 116-136) **Digestive tract evacuation in northern squawfish (Ptychocheilus oregonensis).** Beyer, J.M.; Lucchetti, G.; Gray, G. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

Digestive tract evacuation in northern squawfish (Ptychocheilus oregonensis) (170-1900 g) was studied in fish allowed to feed voluntarily on salmon (4-70 g) at three water temperatures (10, 15 and 20 C). Squawfish were sacrificed at 1- or 2-h intervals until evacuation approximated 90%. Amount of food evacuated for a given time interval increased approximately three times as the temperature was increased and as the prey weight was increased, and two times as the predator weight was increased. The 90% digestive tract emptying time decreased by about two-thirds as the temperature doubled and by about one-half as the predator weight increased 10 times, but approximately doubled when the prey weight increased 4 times. Two-fish meals were evacuated more slowly than meals of one fish weighing 17-20 g, but at the same rate as meals of one fish weighing 35-40 g. Equations derived are easily applied to a wide range of water temperatures, prey weights, and predator weights.

30683 (DOE/BP/34796–4, pp. 137-152) **Gastric evacuation in smallmouth bass (Micropterus dolomieui).** Beyer, J.; Burley, C.C. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

Laboratory experiments were conducted to examine the effects of water temperature (10, 15, 20°C), predator size (29 - 1550g), prey size (0.20-5.0g) and prey number (1-3) on gastric evacuation of juvenile salmon in smallmouth bass (Micropterus dolomieui). The bass were allowed to feed voluntarily and their stomachs pumped at 1-4h intervals until evacuation approximated 90%. The rate of evacuation increased with increases in all the variables examined - meal weight, time, temperature, predator weight, and prey number (listed in order of decreasing importance). The 90% emptying times increased with increasing prey weight, and decreased with increasing temperature, predator weight, and prey number. The emptying times over the range of the variables tested were approximately 3-78h.

30684 (DOE/BP/34796–4, pp. 153-173) **Feasibility of reducing or controlling predation induced mortality of juvenile salmonids in Columbia River reservoirs.** Poe, T.P.; Lofy, P.T.; Duke, S.D.; Nigro, A.A.; Rieman, B.E. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

A recent study was conducted in John Day Reservoir of the Columbia River to determine the significance of predator-induced mortality on outmigrating juvenile salmonids; results of this study indicate that predation by resident fish predators can easily study account for previously unexplained mortality of juvenile salmonids during their seaward migration. The reduction of the mortality of outmigrating juvenile salmonids is a high priority goal of the Northwest Power Planning Council's Fish and Wildlife Plan because this mortality may be one of the major impediments in the restoring Columbia River anadromous salmonid runs. Reductions or control of predation-induced mortality on juvenile salmonids may significantly reduce overall mortality. The authors therefore conducted a preliminary evaluation to determine the feasibility of regulating predation on juvenile salmonids by major predators by: (1) identifying and describing potential predation control measures from the literature, (2) evaluating the biological feasibility of predation control measures and, (3) identifying additional information needs. The results of the preliminary evaluation are reported.

30685 (DOE/BP/34796–4, pp. 174-207) **Functional response of northern squawfish predation to salmonid prey density in McNary Tailrace, Columbia River.** Vigg, S. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

The northern squawfish (Ptychocheilus oregonensis) is a major predator on four species of seaward migrating juvenile salmonids in the Columbia River System: steelhead (Salmo gairdneri), sockeye salmon (Oncorhynchus nerka), coho salmon (O. kisutch), and chinook salmon (O. tshawytscha). The functional response of northern squawfish consumption rate to smolt density was evaluated during the migrations (April-August) in the tailrace of McNary Dam; 2391 squawfish containing 1721 salmonid prey were sampled in 1983-1986. Consumption rate was estimated from stomach contents, and smolt density from dam passage counts. The relation between the gravimetric proportion of smolts in the diet and smolt density is described by an exponential saturation model which indicated that squawfish rapidly changed to an almost exclusively salmonid diet at relatively low smolt densities, and that salmonids were always preferred regardless of their densities. The observed Type III functional response was described statistically by an exponential sigmoid model that predicted the asymptotic consumption rate to be 5.1 smolts x predator $^{-1}$ x d^{-1}.

30686 (DOE/BP/34796–4, pp. 211-248) **Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part III. Abundance and distribution of northern squawfish, walleye, and smallmouth bass.** Beamesderfer, R.C. (Oregon Department of Fish and Wildlife, Clackamas (USA)); Rieman, B.E. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

The authors used mark-recapture and catch-per-unit effort data to estimate abundance and distribution of three potential predators on juvenile salmonids migrating through John Day Reservoir, 1984-86. Northern squawfish Ptychocheilus oregonensis were the most abundant of the three (85,316), followed by smallmouth bass Micropterus dolomieui (34,954) and walleye Stizostedion vitreum vitreum (15,168). Because of uncertainty in sampling and assumptions of the mark-recapture estimator, the combined abundance of these three predators could range between 50,000 and 500,000 on a worst case. They believe, however, that bias is probably negative, and any errors should result in conservative estimates. Northern squawfish were common reservoir-wide but large concentrations were seen in the boat-restricted-zone immediately below McNary Dam. Walleye were largely restricted to the upper third of the reservoir, whereas the number of smallmouth bass increased progressively downriver. Some monthly and annual differences in distribution patterns were observed. Based on abundance and distribution, northern squawfish have the greatest potential for predation. They would also expect predation to be unevenly distributed in time and space based on variation in predator number and distribution.

30687 (DOE/BP/34796–4, pp. 249-273) **Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part IV. Estimated total loss and mortality of juvenile salmonids to northern squawfish, walleye, and smallmouth bass.** Rieman, B.E. (Oregon Department of Fish and Wildlife, Clackamas (USA)); Beamesderfer, R.C. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

The authors estimated the loss of juvenile salmonids Oncorhynchus spp and steelhead Salmo gairdneri to predation by northern squawfish Ptychocheilus oregonensis, walleye Strizostedion vitreum vitreum, and smallmouth bass Micropterus dolomieui, in John Day Reservoir. Their estimates were based on daily prey

consumption and predator numbers from 1983-1986. They estimated mortality based on estimates of the number of juveniles entering the reservoir during the April through August period of migration. The mean annual loss was 2.7 million juvenile salmonids. The 95% confidence interval estimated by Monte Carlo simulation ranged from 1.9 to 3.3 million fish. Northern squawfish accounted for 78% of the total loss. Walleye and smallmouth bass accounted for 13% and 9%, respectively. Twenty-one percent of the loss occurred in a small area immediately below McNary Dam at the head of the reservoir. They estimated that the three predator fishes consumed 14% of all juvenile salmonids that entered the reservoir with 95% confidence limits of 9% to 19%. Mortality changed by month and was higher late in the season. The range of monthly mortality estimates was 7% in June to 61% in August. Chinook salmon, which migrated in July and August experienced higher mortality from predation than other salmon and steelhead. Although they show uncertainties in the estimates, predation by resident fish predators in John Day Reservoir can easily account for previously unexplained mortality of juvenile salmonids. Alteration of the Columbia River by dams, and a decline in the number of salmonids could have increased mortality caused by predation, making predation more important than in the past.

30688 (DOE/BP/34796–4, pp. 274-306) **Population dynamics of northern squawfish and potential predation on juvenile salmonids in a Columbia River reservoir.** Rieman, B.E. (Oregon Department of Fish and Wildlife, Clackamas (USA)); Beamesderfer, R.C. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

Northern squawfish Ptychocheilus oregonensis are an important predator on salmonid smolts in Columbia River reservoirs. To better understand predation the authors described growth, mortality, and the variation in year-class strength of northern squawfish in John Day Reservoir. They used a correlation analysis to examine variables related to recruitment. They used simulations to describe expected changes in predation caused by variation in recruitment or by exploitation. Growth of northern squawfish in John Day Reservoir was high relative to other populations. Estimates of mortality were uncertain but a best estimate of 0.25 was equivalent to mortality estimated in a similar population and mortality estimated from an empirical model. Indexes of year-class strength varied, but recruitment from an empirical model. Indexes of year-class strength varied, but recruitment was not obviously related to environmental variables. Year-class strength was negatively associated with concurrent year-class strength of walleye Stizostedion vitreum vitreum another predator. Simulated predation varied with recruitment and trends increasing or decreasing by more than 50% of the mean developed over periods of about 10 years. Simulated predation declined with exploitation. Sustained exploitation on the order of 10% to 20% annually reduced predation by 50% or more. The magnitude of change was related to reproductive compensation. They believe that limited, but sustained, exploitation of northern squawfish provides an alternative to more radical control measures.

30689 (DOE/BP/34796–4, pp. 307-348) **Population dynamics of walleye and smallmouth bass and potential on salmonid smolts in John Day Reservoir.** Connolly, P.J. (Oregon Department of Fish and Wildlife, Clackamas (USA)); Rieman, B.E. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

The authors described potential predation on salmonid smolts (Oncorhynchus spp. and Salmo gairdneri) as a function of the population dynamics of walleye Stizostedion vitreum vitreum and smallmouth bass grew well in John Day Reservoir of the Columbia River. Walleye and smallmouth bass grew well in John Day Reservoir relative to other populations in northern USA and southern Canada. Their best estimates of total instantaneous mortality were 0.60 for walleye and 0.50 for smallmouth bass. Year-class strength was much more variable for walleye than smallmouth bass. Walleye year-class strength was correlated negatively with annual mean flow and correlated positively with higher water level in March and higher water temperature during June through August. Year-class strength of smallmouth bass was not strongly correlated with any environmental variable. Strength of walleye and smallmouth bass year classes were correlated positively with length at age 1. The relative importance of walleye and smallmouth bass as predators of salmonid smolts changed with structure of the populations. Predation was characterized by early participation of walleye and smallmouth bass, but was short-lived because consumption of smolts and predator number declined quickly with age. Since a short lag period existed before predation on smolts began, variation in year-class strength of walleye and smallmouth bass rapidly affected predation. Simulated interactions of exploitation and size limits for walleye and smallmouth bass did not strongly influence predation except at higher than reported rates of exploitation and smaller than desirable sizes at harvest.

30690 (DOE/BP/34796–4, pp. 349-377) **Simulation of predation by a resident fish on juvenile salmonids in a Columbia River Reservoir.** Beamesderfer, R.C. (Oregon Department of Fish and Wildlife, Clackamas (USA)); Rieman, B.E.; Vigg. S. Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Nov 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir. Final report, 1983-1986: Volume 1, Final report of research.* Order Number DE89004407/JAW. Available from NTIS, PC A17/MF A01; 1.

The authors constructed a model of predation by northern squawfish Ptychocheilus oregonensis on juvenile salmonids migrating through John Day Reservoir. The model predicts mortality as a function of numbers of predators, distribution of predators, number of prey entering the reservoir, residence time of prey, water temperature, and flow. The model predicted mortality similar to that estimated from 1983-86, and also approximated differences among areas and months. Uncertainty analyses show predation mortality may vary threefold with normal annual variation in predator number, temperature, and flow. Mortality in 1983-86 was similar to the average predicted from 30 years of historic environmental data. Sensitivity analyses imply the best avenues for reducing predation are to reduce the number of predators, to pass salmonids earlier in the year, and to maintain runs of juvenile salmonids no less than present levels. Mortality, under the assumptions of the model, is little affected by changes in predator distribution, changes in consumption rate near the upstream dam, increases in number of prey, and decreases in residence time corresponding to increases in flow.

30691 (DOE/BP/34796–5, pp. 2-10) **Prototype water reuse system.** Lucchetti, G.L.; Gray, G.A. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Jul 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986: Volume 2: Supplemental papers and data documentation: Final report.* Order Number DE89004406/JAW. Available from NTIS, PC A09/MF A01; 1.

A small scale water reuse system (150 L/min) was developed to create an environment for making observations on fish under a variety of temperature regimes. Key concerns of disease control, water quality, temperature control, and efficiency and ease of operation were addressed. Northern squawfish (Ptychocheilus oregonensis) were held at loading densities ranging from 0.11 to 0.97 kg/L/min and at temperatures 10 to 20 C (plus minus) 0.5) for six months with no disease problems or degradation of water quality in the system, and minimal system maintenance.

30692 (DOE/BP/34796–5, pp. 33-52) **Use of diagnostic bones to identify and estimate original lengths of ingested prey fishes.** Hansel, H.C.; Duke, S.D.; Lofy, P.T.; Gray, G.A. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Jul 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986: Volume 2: Supplemental papers and data documentation: Final report.* Order Number DE89004406/JAW. Available from NTIS, PC A09/MF A01; 1.

The authors examined and measured cleithra, dentaries, opercles, and pharyngeal arches – bones found to persist during digestion of most prey fish - to identify 24 prey fish species and back calculate their original fork length. Eighteen of the 24 species examined could be easily distinguished, however, for certain congenerics identification was neither consistent nor reliable for all bones within the size ranges examined. Relations between bone length and fish length were linear for 14 species for which the sample size was adequate ($N > 30$); coefficients of determination (r^2) ranged from 0.79 to 0.99. Diagnostic characteristics and measurements of these bones provided reliable identification of genera and species and estimates of original fork lengths of partly digested prey fish from three predators. This method, compared with that of examining only prey fish in a measurable condition, greatly increased the amount of dietary information available from gut analysis.

30693 (DOE/BP/34796–5, pp. 53-66) **Variation in capture efficiency of a beach seine for small fishes.** Parsley, M.J.; Palmer, D.E.; Burkhardt, R.W. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Jul 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986: Volume 2: Supplemental papers and data documentation: Final report.* Order Number DE89004406/JAW. Available from NTIS, PC A09/MF A01; 1.

The authors tested the capture efficiency of a beach seine in an enclosed area with the objective of improving their estimates of abundance of small fishes of different taxa in littoral areas. Capture efficiency for 14 taxa representing nine families was determined by seining within an enclosure at night over fine and coarse substrates. Mean efficiency ranged from 12 percent for prickly sculpin (Cottus asper) captured over coarse substrates to 96 percent for peamouths (Mylocheilus caurinus) captured over fine substrates. Mean seine capture efficiency for a taxon was generally higher over fine substrates than over coarse substrates, although mean capture efficiencies over fine substrates were significantly greater for only three of ten taxa. Capture efficiency generally was not influenced by the number of fish available to the seine or by water temperature. Seine catches adjusted to account for capture efficiency showed that conclusions drawn from the apparent abundance in the catch and those drawn from catches adjusted to account for capture efficiency differed because taxa with low capture efficiencies became more important in the adjusted catch.

30694 (DOE/BP/34796–5, pp. 72-88) **Effects of variation in flow on distributions of northern squawfish in the Columbia River below McNary Dam.** Faler, M.P.; Miller, L.M.; Welke, K.I. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Jul 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986: Volume 2: Supplemental papers and data documentation: Final report.* Order Number DE89004406/JAW. Available from NTIS, PC A09/MF A01; 1.

The movements of northern squawfish (Ptychochelius oregonensis) were monitored using radio-telemetry below a Columbia River hydroelectric dam during the outmigration of juvenile anadromous salmonids in 1984 and 1985. Northern squawfish were associated with protected shoreline areas in spring and early summer when discharge rates were high but moved into close proximity of the dam and the juvenile by-pass outflow area in mid to late summer when discharge rates decreased. Similar trends in northern squawfish movements were found when abrupt changes in discharge occurred. Movements out of protected areas and into the main river channel were observed in 4 out of 5 northern squawfish monitored during short-term spill closures. Northern squawfish appeared to avoid high velocity areas. Surface water velocity measurements taken at 81 locations where northern squawfish occurred in June, July and August, 1985, ranged from 0 to 70 cm/sec with a mean of 24.5 cm/sec. These results suggest that predation by northern squawfish at fish passage facilities may be reduced by placing by-pass outflows in areas of high water velocity.

30695 (DOE/BP/34796–5, pp. 90-107) **Size selectivity and bias in estimates of population parameters of smallmouth bass, walleye, and northern squawfish in a Columbia River reservoir.** Beamesderfer, R.C. (Oregon Department of Fish and Wildlife, Clackamas (USA)); Rieman, B.E. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Jul 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986: Volume 2: Supplemental papers and data documentation: Final report.* Order Number DE89004406/JAW. Available from NTIS, PC A09/MF A01; 1.

The authors sampled smallmouth bass (Micropterus dolomieui), walleye (Stizostedion vitreum), and northern squawfish (Ptychocheilus oregonensis) in John Day Reservoir on the Columbia River from 1983-86 with five types of gear: two types of gillnets, boat electrofishers, trapnets, and angling. Different gears selectively sampled different sizes for each species. Recapture rates indicated that different sizes of fish remained differentially vulnerable to capture in pooled gear samples. Vulnerability of smallmouth bass and walleye declined with increasing size. Vulnerability of northern squawfish increased with size. Size selectivity of gear resulted in estimates of abundance potentially biased by 2 to 16%, estimates of proportional stock density (size structure) biased by 11 to 46%, and estimates of annual rate of mortality biased by 17 to 69%. The bias was negative in estimates of abundance and varied in estimates of size structure and mortality dependant of the pattern of vulnerability. In any long term monitoring of a population, investigation of the nature of the bias resulting from size selectivity would seem prudent.

30696 (DOE/BP/34796–5, pp. 11-32) **Method to directly measure maximum volume of fish stomachs or digestive tracts.** Burley, C.C.; Vigg, S. USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Jul 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986: Volume 2: Supplemental papers and data documentation: Final report.* Order Number DE89004406/JAW. Available from NTIS, PC A09/MF A01; 1.

A new method for directly measuring maximum stomach or digestive tract volume of fish incorporates air injection at constant pressure with water displacement to directly measure the internal volume of a stomach or analogous structure. The method was tested with coho salmon, Oncorhynchus kisutch (Walbaum), which have a true stomach, and northern squawfish, Ptychocheilus oregonensis (Richardson), which have a modified foregut as a functional analog. Both species were collected during July-October 1987 from the Columbia River, USA. Relations between fish weight (= volume) and maximum volume of the digestive organ were best fitted to coho salmon by an allometric model and to northern squawfish by an exponential model. Least squares regression analysis of individual measurements showed less variability in the volume of coho salmon stomachs than in the total digestive tracts and foreguts of northern squawfish, relative to fish size. Compared to previous methods, the new technique has the advantages of accurate measuring the internal volume of a wide range of digestive organ shapes and sizes, and of having an objective measure of final inflation pressure.

30697 (DOE/BP/34796–5, pp. 108-138) **MOCPOP: a flexible simulator for analysis of age-structured population and stock-related functions.** Beamesderfer, R.C. (Oregon Department of Fish and Wildlife, Clackamas (USA)). USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Jul 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986: Volume 2: Supplemental papers and data documentation: Final report.* Order Number DE89004406/JAW. Available from NTIS, PC A09/MF A01; 1.

MOCPOP is a program for simulating annual variation in a population of organisms based on recruitment, mortality, and growth. Commonly used models of population dynamics, including stock-recruitment, logistic (surplus production), dynamic pool (yield), and Leslie matrix or combinations or portions of these models can be approximated with MOCPOP. MOCPOP tracks population size in

numbers and biomass, and also calculates numbers of particular interest to harvest managers including yield, number of harvestable individuals, and an index of population size structure. It provides the flexibility to simulate a variety of populations and population processes with a minimum of experience with microcomputers and no knowledge of computer language or programming.

30698 (DOE/BP/34796–5, pp. 139-159) **User's guide for RESPRED: a model of predation by resident fish on juvenile salmonids in a Columbia River reservoir.** Beamesderfer, R.C. (Oregon Department of Fish and Wildlife, Clackamas (USA)). US-DOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife; Fish and Wildlife Service, Cook, WA (USA); Oregon Dept. of Fish and Wildlife, Clackamas, OR (USA). Jul 1988. In *Predation by resident fish on juvenile salmonids in John Day Reservoir, 1983-1986: Volume 2: Supplemental papers and data documentation: Final report.* Order Number DE89004406/JAW. Available from NTIS, PC A09/MF A01; 1.

RESPRED incorporates factors we know or suspect regulate predation mortality of juvenile salmonids in John Day Reservoir. This model was written to organize our understanding of processes that regulate mortality of salmonids, to predict changes in predation over time with normal variation of the regulating factors, and to evaluate alternative strategies for reducing predation. Programming was built around processing to aide manipulation of input population parameters and inspection of simulation results.

30699 (OH/RD–513G543) **Behavioural systems to guide or divert fish at hydro-electric facilities.** Patrick, P.H.; McKinley, R.S. Ontario Hydro Research Div., Toronto, ON (Canada). 1987. 45p. (CE–02598). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Losses of downstream migrating fish due to turbine related injuries represents a serious environmental problem at hydroelectric facilities. The objective of this study was to evaluate the effectiveness of behavioural systems identified at field sites representative of both downstream migrating salmonid and non-salmonid species. Methods of fish protection for potential use at hydroelectric facilities can be divided into physical and behavioural systems. Behavioural systems rely on the behavioural responses of fish to controlled stimuli, which may include a visual stimulus, an acoustical stimulus and/or combination of both. Behavioural systems have potential for diverting fish away from the turbines in the case of downstream migrants, or towards a fish ladder in the case of upstream migrants. These systems do not affect station operation, have no apparent negative impact on fish, and are relatively inexpensive. Field experiments were conducted on the effectiveness of selected behavioural systems in guiding or diverting downstream migrating fish. Results indicate the potential of behavioural methods to control salmon smolt migration at hydroelectric plants. 31 refs., 7 figs., 4 tabs.

1307 Power-conversion Systems

Refer also to citation(s) 31671

14 SOLAR ENERGY

Refer also to citation(s) 33023

1401 Resources and Availability

Refer also to citation(s) 30709

30700 (SERI/SP–220-3458) **Focusing on the future: Solar thermal energy systems emerge as competitive technologies with major economic potential.** Solar Energy Research Inst., Golden, CO (USA). Mar 1989. 15p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000851/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Hundreds of thousands of US citizens are now receiving a portion of their daily demand for electricity from large-scale solar thermal electric generating stations-power plants that use concentrated solar energy to drive electric power generators. Just as with coal, fuel oil, natural gas, and nuclear energy, concentrated solar energy can create working temperatures of around 600°C and much higher. Also, solar power plants contribute almost nothing to the atmospheric greenhouse effect and pose few, if any, of the other environmental problems associated with conventional energy sources. As a result of research and development within the national Solar Thermal Technology Program of the US Department of Energy (DOE), solar thermal energy is on the threshold of competing economically with conventional power plants and is now viable for international markets. Its potential for spurring American economic growth and exports is significant.

1403 Economics

Refer also to citation(s) 30709

1405 Solar Energy Conversion

Refer also to citation(s) 30657, 30658, 30659, 30660, 30661, 30662, 30663, 30664, 30665, 30666, 30667, 30668, 30669, 30670, 30671, 30818, 30984, 31039, 31040, 31293, 31522, 31531, 31537, 31554, 31679, 31937, 32090

30701 (CONF-890692–1) **The effect of nitrogen accumulation and nitrification on soil chemical properties in alder forests.** Van Miegroet, H.; Cole, D.W.; Binkley, D.; Sollins, P. Oak Ridge National Lab., TN (USA). 1989. 17p. Sponsored by DOE/ER;EPRI;OGA. DOE Contract AC05-84OR21400. BSR-841678;RP-2621. From 82. Air and Waste Management Association annual meeting and exhibition; Anaheim, California, USA; 25-30 Jun 1989. Order Number DE89008236/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper looks at the effect of alder occupancy on soil chemical properties, based on information reported in the literature and on data from selected studies in Washington and Oregon. We will assess the role of nitrification as an acidifying process and evaluate its influence on soil sensitivity to further acidification. Finally, the implication of these findings with respect to acid deposition research is discussed. 37 refs., 2 figs., 4 tabs.

30702 (DOE/CH/10093–53) **Biofuels program summary: Volume 1, Overview fiscal year 1988.** Solar Energy Research Inst., Golden, CO (USA). Mar 1989. 17p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89012254/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Within the US Department of Energy (DOE), the Biofuels and Municipal Waste Technology Division is working to ensure that the technology for providing economical, plentiful, and renewable supplies of liquid and gaseous fuels will be available when the nation needs them. To this end, research is being pursued on carefully selected pathways leading to the production of renewable gasoline, diesel, and alcohol fuels, as well as pipeline-quality gas. During fiscal year 1988, the National Biofuels program continued to make progress in all areas of research, reinforcing the confidence that the research goals necessary to unlock the energy potential of biofuels are both reasonable and achievable.

30703 (DOE/CH/10093–54) **Biofuels Program summary: Volume 2, Research summaries, fiscal year 1988.** Solar Energy Research Inst., Golden, CO (USA). Apr 1989. 240p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000869/JAW. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

The Biofuels and Municipal Waste Technology (BMWT) Division of the US Department of Energy is responsible for research and development (R and D) of technologies for producing liquid and gaseous fuels from biomass (organic materials such as trees, municipal solid waste, aquatic plants, and crops). The program addresses both production (growth) of biomass and its conversion to fuels. Major progress has been made toward the goal of developing cost-competitive biofuels technologies for the next decade and beyond. The Biofuels Program Summary consists of a two-volume

reference set describing the technological advances and future R and D directions of the Biofuels Program for fiscal year 1988. Volume 2 (Research Summaries) is a compilation of detailed descriptions of the various R and D projects performed by the national laboratories and their subcontractors from industry, university, and nonprofit research institutions. It also contains a bibliography of the various journal articles and publications produced under the program in recent years.

30704 (DOE/ER/13717–1) **The role of proteolytic enzymes in degradation of plant tissues: Summary report.** Lewosz, J.; Kelman, A.; Sequeira, L. Wisconsin Univ., Madison, WI (USA). [1989]. 5p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER13717. Order Number DE89013197/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The proteolytic enzymes produced by Erwinia carotovora subsp. carotovora (Ecc-strain SR 394) grown on various media were examined by isoelectrofocusing in polyacrylamide gels over a pH range of 3-10. In addition to the main protease present in culture filtrates, low concentrations of several other proteases were present in extracts from potato tubers infected by Ecc. Proteases from all these sources were similar and had the following properties: pH optimum near 8.0, calcium dependent, insensitive to serine proteinase and SH-proteinase inhibitors, inhibited by EDTA, and highly thermostable. These enzymes degraded gelatin, soluble collagen and Hide Powder Azure, and showed weak activity on casein, but did not degrade insoluble collagen or elastin.

30705 (DOE/ID/12584–29) **Evaluation of the performance characteristics of radon and radon-daughter concentration measurement devices under controlled environmental conditions.** Pearson, M.D. UNC Geotech, Grand Junction, CO (USA). Apr 1989. 152p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-86ID12584. (UNC/GJ–44(TMC)). Order Number DE89012262/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The Technical Measurements Center (TMC) conducted a study to expose 10 radon and 7 radon-daughter concentration measurement devices in the DOE/GJPO Radon/Radon-Daughter Environmental Chamber for a series of 24 controlled-environment tests. The tests evaluated the devices' response to temperature, relative humidity, dew point, condensation-nuclei concentration, radon-daughter/radon equilibrium ratio, and non-uniform radon and radon-daughter concentration. Devices were evaluated for linear response as a function of concentration. In addition to response to environmental parameters, the evaluation included determining the utility of the devices in providing reasonable assurance of compliance with the radon and radon-daughter concentration standards for DOE remedial action programs. This reasonable assurance criterion is based on a coefficient of variation of 25 percent for devices deployed for year-long measurements and a coefficient of variation of 18 percent for devices deployed for intermittent sampling. 39 refs., 65 figs., 33 tabs.

30706 (LBL–25317) **Biomimetic catalysis: Hydroxylation of C_2, C_3, and cycloC_6 hydrocarbons by managanese porphyrin and non-porphyrin catalysts in the presence of monooxygen transfer reagents.** Fish, R.H.; Fong, R.H.; Price, R.T.; Vincent, J.B.; Christou, G. Lawrence Berkeley Lab., CA (USA). Aug 1988. 10p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8806362–1: ACS symposium on biomimetic catalysis, Toronto, Canada, 5-10 Jun 1988). Order Number DE89011773/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Metal complexes that mimic the active site of monooxygenase enzymes and convert carbon-hydrogen bonds to carbon-hydroxyl in the presence of a monooxygen transfer reagent are called biomimetic catalysts. Studies concerning the activation of methane, ethane, propane, and cyclohexane to their respective alcohols with biomimetic catalysts that encompass manganese supramolecule porphyrins and open-faced porphyrins, manganese non-porphyrin tri and tetranuclear clusters and a mononuclear manganese-substituted Keggin ion in the presence of monooxygen transfer reagents such as iodosylbenzene and t-butyl hydroperoxide will be discussed. 6 refs., 1 fig., 3 tabs.

30707 (PB–89-165914/XAB) **Research on tandem solar cells. Volume 1. Final report. Volume 2. Appendices. Report for 15 May 1984-1 August 1985.** Borrego, J.M.; Ghandhi, S.K. Rensselaer Polytechnic Inst., Troy, NY (USA). Rensselaer Color Measurement Lab. Mar 1986. 348p. Available from NTIS, PC A15/MF A01.

The various materials used to produce solar cells each convert a specific portion of the solar spectrum. Since most solar cells are made using material of one band gap of the solar spectrum, a significant portion of the sun's energy is left untapped if used inefficiently. In this project, two different materials – gallium arsenide (GaAs) and germanium (Ge) – were combined for the efficient use of a broader range of the solar spectrum. The tandem cells designed for the project use a top layer of aluminum gallium arsenide (AlGaAs) to act as a window, letting sunlight react with a layer of GaAs. Any portion of the solar spectrum not captured by the GaAs layer is passed through to the bottom layer of Ge for conversion. The solar-cell construction was designed and tested using computer simulations. Results indicate that this tandem cell design can be much more efficient than cells made from a single material. Higher efficiencies were found to be potentially achievable using AsGaAs-GaAs-Ge tandem solar cells than with single band-gap cells. The researchers also experimented with different fabrication techniques to produce these cells.

30708 (SERI/PR–211-3483) **Photovoltaic Program Branch annual report, FY 1988.** Solar Energy Research Inst., Golden, CO (USA). Mar 1989. 291p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000898/JAW. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

This report summarizes the progress of the Photovoltaic (PV) Program Branch of the Solar Energy Research Institute (SERI) from October 1, 1987 through September 30, 1988. The branch is responsible for the management of the subcontracted portion of SERI's PV Advanced Research and Development Project. In fiscal year 1988, this included more than 55 subcontracts with a total annualized funding of approximately $13.5 million. Approximately two-thirds of the subcontracts were with universities at a total funding of nearly $4.7 million. The six technical sections of the report cover the main areas of the subcontracted program: the Amorphous Silicon Research Project, Polycrystalline Thin Films, Crystalline Silicon Materials Research, High-Efficiency Concepts, the New Ideas Program, and the University Participation Program. Technical summaries of each of the subcontracted programs provide a discussion of approaches, major accomplishments in FY 1988, and future research directions.

30709 (SERI/SP–211-3488) **Department of Energy trip report: Review of the US photovoltaics industry conducted in November and December 1988.** Solar Energy Research Inst., Golden, CO (USA); USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (USA). Photovoltaic Energy Technology Div.; Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 32p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000883/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report summarizes the results of a review of the photovoltaics industry conducted during a tour of various companies by representatives from the US Department of Energy, the Solar Energy Research Institute, and Sandia National Laboratories in November and December 1988. The report describes an industry in transition, in which there is a strong need and drive to achieve profitability in the near term in order to maintain investors' confidence. A major industry drive to achieve profitability is toward larger production facilities, leading to lower manufacturing costs. Investment to support manufacturing development is dependent upon an expansion of the photovoltaic market, which is currently too small to maintain the current industry. A summary of industry recommendations is given concerning the stimulation of market expansion and growth in the industry through the 1990s.

30710 (SERI/SP–231-3245 A.44-A.54) **Experimental studies of the progressing batch reactor.** Bergeron, P.W. Solar Energy

Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

A series of single percolation reactor experiments has been completed to provide a baseline for the multi-reactor experiments to follow. When operating in the liquid downflow configuration, yields of glucose ranged from 45 to 61 percent, and product concentrations of glucose from 6.4 to 9.8 g/l. When results from experiments using normal chip sizes of 1/2 (1.27cm), 1/4 (.635cm), and 1/8 (.318cm) inches were compared, the best results were obtained with the 1/4 inch chips. The variability of results using 1/4 inch chips (not seen with 1/2 inch chips) led to the conclusion that reactor hydrodynamics plays a significant role when using nominal chip sizes smaller than 1/2 inch. The results from liquid upflow experiments were significantly inferior to those from the downflow experiments.

30711 (SERI/SP–231-3245 B.13-B.37) **Dilute acid pretreatment of biomass.** Grohmann, K.; Torget, R.; Wright, J.; Himmel, M. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

A preliminary process design for dilute acid pretreatment of aspen wood chips has been prepared and subjected to an economic evaluation. The process design was prepared according to experimental data on the kinetics of dilute acid prehydrolysis and particle size effects obtained in this study. The initial economic evaluation shows that the production costs for the fermentable sugar products are primarily governed by feedstock costs while capital investment and energy costs are less important. The predominant capital cost is associated with an expensive acid resistant pretreatment reactor, while a large fraction of the total electricity energy is needed for dry milling of aspen chips to small particles needed for rapid acid penetration and enzymatic saccharification. The results indicate that improvements in the process design will require development of a cheaper pretreatment reactor and a less energy intensive comminution system. The authors have also completed initial investigations of the conditions for complete removal of lignin from acid treated aspen wood meal and wheat straw with dilute aqueous solutions of sodium hydroxide in the temperature range of 100 - 160°C. The alkaline delignifications produce highly digestible cellulosic substrates but are in most cases accompanied by significant losses of cellulose. Dilute acid pretreatment of aspen bark has also been recently initiated.

30712 (SERI/SP–231-3245 B.107-B.116) **Modeling of Brettanomyces clausenii growth on mixtures of glucose and cellobiose.** Bynum, M.T. (Univ. of Colorado, Boulder (USA)); Kompala, D.S.; Grohmann, K.; Wyman, C.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The sequential utilization of glucose and cellobiose during anaerobic fermentations of Brettanomyces clausenii was investigated to develop a mathematical model for a simultaneous saccharification and fermentation process. Fermentation of cellobiose was found to be mediated by the presence of extracellular B-glucosidase, which is repressed and inhibited by glucose. A kinetic model containing a number of parameters, which can be determined experimentally, was developed for simulating the dynamics of yeast fermentation of mixtures of glucose and cellobiose. An alternative cybernetic model, which is based on the viewpoint that microbial behavior is the outcome of an instantaneous optimization strategy to maximize their growth rate, is also developed using a much smaller number of parameters. Both models were shown to be similarly capable of simulating the yeast growth dynamics in batch cultures, as well as perturbed cultures with intermittent additions of glucose.

30713 (SERI/SP–231-3245 B.117-B.129) **Mixing requirements for enzymatic hydrolysis of cellulose.** Elander, R.T. (Colorado State Univ., Fort Collins (USA)); Murphy, V.G. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The effect of agitation on the enzymatic hydrolysis of cellulose was studied in a 5.0 L stirred tank reactor using a substrate concentration of 5.0 percent (w/v) and an enzyme/substrate ratio of 20 IU/g dry substrate. Solka-Floc, a purified form of wood cellulose, was used as the substrate. All experiments pointed to the fact that some level of agitation is required in order to achieve maximum conversion of cellulose to glucose in any given time period. The primary mass transfer process influenced by agitation is almost certainly the transport of (enzyme inhibiting) glucose and cellobiose away from reaction sites on the (solid) cellulose. In experiments with a flat blade impeller, maximum conversion of cellulose coincided with the agitation rate (65 rpm) required to completely suspend the particles. Increasing the stirring rate above this level had no effect on the rate of conversion. In experiments with an anchor impeller, which actually moved through the bed of cellulose at all stirring rates, complete suspension occurred at 25 rpm and maximum conversion at 40 rpm. More important, however, was the fact that stirring at a rate as low as 7.5 rpm resulted in a conversion that was 87 percent of the maximum observed. At this speed the anchor impeller consumed only 2 percent of the power required by the turbine operating at 65 rpm.

30714 (SERI/SP–231-3245 B.165) **Enzymology research.** Himmel, M.E.; Grohmann, K. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Enzymology research at SERI in FY 1986-87 has focused on the problem of enhancing the effective lifetime of the key fungal cellulase enzymes under process conditions, since the cost of producing these enzymes has been identified as a sensitive issue in the overall bioconversion economics. The effective utilization of cellulase hydrolysis potential in these process schemes requires access to enzymes of high stability and a scheme for recovery of this activity before disposal of spent feedstock. The issue of adsorptive loss of cellulase activities was studied in FY 1987 and is reported here. Also reported in this document are studies designed to quantitatively describe the instability of the native fungal beta-glucosidase and to then investigate chemical crosslinking technology as a toll for achieving greater stability. In the process of performing this work a new affinity chromatography method was developed and is also described herein. Progress was also made in FY 1987 on the characterization of the highly thermostable cellulase enzymes secreted by the new thermophile Acidothermus cellulolyticus and these studies are reported as well.

30715 (SERI/SP–231-3245 B.166-B.180) **Digestion of pretreated aspen substrates: hydrolysis rates and adsorptive loss of cellulase enzymes.** Tatsumoto, K.; Baker, J.O.; Tucker, M.P.; Oh, K.K.; Himmel, M.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Considerable controversy exists concerning exists concerning the role lignin plays in the adsorption of cellulase enzymes on biomass. Recent studies using extracted, purified hardwood lignin have shown these materials have a propensity for cellulase adsorption; native lignin is, however, carbohydrate-linked and far less condensed. In this study the authors report the results of adsorption-kinetics analyses of cellulase-complex activities using five pretreated aspen substrates, including an exhaustively enzyme-hydrolyzed one. These data indicate that the polymer-binding cellulase activities are removed from solution at higher rates and extents in the presence of low lignin-content versus high lignin-content substrates. This order of adsorption was found to be essentially the inverse for beta-glucosidase adsorption.

30716 (SERI/SP–231-3245 B.181-B.186) **Denaturation behavior of fungal and thermostable-bacterial beta-glucosidases.** Baker, J.O.; Tucker, M.P.; Oh, K.K.; Himmel, M.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The purpose of this study was to establish an understanding of the unfolding (denaturation) process of important beta-glucosidases on a quantitative level, so that the effectiveness of chemical crosslinking methods may be evaluated. The work of Durand

(1984), Duff (1986) and others confirms that fungal beta-glucosidases are more sensitive to thermal denaturation than the filter paper degrading enzyme activities. In order to establish an understanding of the unfolding process of important beta-glucosidase on a quantitative level - so that the effect of crosslinking the enzymes could be accurately measured - the enzymology team collected data on the thermal denaturation of three industrially important beta-glucosidases, using two types of direct physical measurement, differential scanning microcalorimetry (DSC) and wavelength/temperature scanning fluorimetry, in addition to classical activity measurements of the denaturation process.

30717 (SERI/SP–231-3245 B.187-B.190) **Beta-glucosidase crosslinking for stability and enzyme recycle.** Baker, J.O.; Oh, K.K.; Himmel, M.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

A major problem encountered in carrying out cellulose digestion at high temperatures is the low thermal stability of commercial beta-glucosidase preparations, compared with the thermal stability of the other components of the cellulose complex. Provision of a more thermostable beta-glucosidase component would therefore result in substantial increase in efficiency for the process as a whole. In an application of interest to those concerned with the production of soluble enzymes of high thermal stability, Woodward et al, reported that treatment of a commercial enzyme mixture with glutaraldehyde resulted in a substantial increase in the resistance to thermal denaturation shown by the beta-glucosidase activity present in the mixture. Since the study by Woodward was carried out using a commercial mixture containing a variety of chemical species other than the beta-glucosidase, one should consider the possibility that the observed stabilization might have been due to attachment of the beta-glucosidase to some of these other species, in addition to crosslinking of the beta-glucosidase itself. In order to answer questions concerning the general principles that control stabilization of enzymes by crosslinking reagents, the authors decided to extend the studies of Woodward by (1) purifying the beta-glucosidase activity and using the purified enzyme for crosslinking studies, (2) following the thermal inactivation kinetics for both native and modified enzyme over longer periods of time, (3) applying other crosslinkers that have only recently become available, and (4) developing effective methods for separating stabilized from non-stabilized enzyme, thus making possible the study of the stabilized enzyme in isolation, rather than as component(s) of a mixture.

30718 (SERI/SP–231-3245 B.191-B.192) **Synthesis of an affinity gel for purification of beta-glucosidases.** Grohmann, K.; Oh, K.K.; Himmel, M.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The purification of beta-glucosidases from spent fungal or bacterial growth media can be a multi-step operation requiring months of effort. Also, the limiting quantity of beta-glucosidase compared to other proteins present in growth supernatants and cell lysates makes classical purification (i.e., repetitive gel filtration and ion-exchange chromatography) difficult and ineffective. Late in FY 1987 the authors examined the applicability of an immobilized substrate-analog affinity approach to purification of these enzymes.

30719 (SERI/SP–231-3245 B.193-B.197) **Visualization and stoichiometry of the active-enzyme cellulase complex from Trichoderma reesei.** Ellis, R.P. (Colorado State Univ., Fort Collins, CO (USA)). Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The authors propose to elucidate the visualization and stoichiometry of the enzymes endoglucanase I (EGI) and cellobiohydrolase I (CBHI) in their action on cellulose. In addition, they plan to develop methods for purification of milligram or greater quantities of these enzymes utilizing antibody affinity column chromatography. Thus the monoclonal antibodies produced for each enzyme will be utilized for both enzyme visualization and enzyme purification. Although initially the production of monoclonal antibodies is more expensive than production of polyclonal antibodies, the hybridomas generated for monoclonal antibody production can be stored in liquid nitrogen indefinitely, and thus will serve as a non-exhaustive source for production of monoclonal antibodies. Transmission electromicroscopic examination of substrate-enzyme-monoclonal antibody-gold complexes and mica-substrate-enzyme-monoclonal antibody-gold complexes are both proposed to ensure that optimum visualization is achieved.

30720 (SERI/SP–231-3245 B.199-B.209) **Hydrolysis of cellulose by purified cellulase components: synergistic effects.** Woodward, J. (Oak Ridge National Lab., TN (USA)); Lee, N.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Collaborative research between ORNL and SERI has recently been initiated. Research progress on one effort - the hydrolysis of cellulose by purified cellulase components - is reported in this paper. The adsorption of purified cellobiohydrolases (CBH I and II) and endoglucanases (EG I and II) from Trichoderma reesei strain L27 to microcrystalline cellulose (Avicel) has been studied. Scatchard analysis of the adsorption data gave the maximum amount of each component that bound to Avicel at saturation. Hydrolysis of Avicel was thus carried out by saturating and non-saturating (50% saturation) concentrations of cellulase components alone and in combination with each other, and it was found that the greatest amount of synergism between them was observed when Avicel was incubated with non-saturating concentrations of enzyme. Synergism was observed between CBH I and CBH II, as well as between EG I and CBH I; however, inhibition of hydrolysis occurred using a combination of EG I and EG II. Synergism between cellulase components may be significant during cellulose hydrolysis only when non-saturating enzyme concentrations are used.

30721 (SERI/SP–231-3245 B.210-B.217) **Thermostable cellulase enzymes from Acidothermus cellulolyticus: studies with growth media activities.** Tucker, M.P.; Mohagheghi, A.; Himmel, M.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The authors recently reported the isolation of Acidothermus cellulolyticus gen. nov., sp. nov., a moderately thermophilic, aerobic, cellulolytic bacterium, from the acidic hot springs of northern Yellowstone National Park, Wyoming. In the present study they report that the endo-beta-1,4-glucanase, beta-glucosidase and saccharifying cellulase activities produced by this bacterium possess the highest temperature optima reported to date. Acidothermus cellulolyticus ATCC 43068 was found to grow optimally at pH 5.5 and 55°C utilizing a wide variety of simple sugars and/or cellulose as carbon source in minimal media. These conditions for cell growth were found, not surprisingly, to closely resemble those discovered at the hot spring site itself. When grown in the laboratory on minimal media with trace addition of yeast extract in the presence of cellobiose or a microcrystalline cellulose such as Sigmacell 50, these cultures actively secrete a cellulase enzyme complex producing cellobiose as the final product.

30722 (SERI/SP–231-3245 B.218-B.219) **Purification and partial characterization of two endoglucanases from Acidothermus cellulolyticus.** Tucker, M.P.; Himmel, M.E. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The goal of this study was to further understanding of bacterial cellulase systems through the isolation and characterization of the principal enzymes involved in the saccharification process. The new thermotolerant bacterium Acidothermus cellulolyticus was chosen for this study as it has potential for commercial applications and secretes highly thermostable cellulase enzymes. This system was found to consist of two key components, a high molecular weight enzyme (EGH) and a low molecular weight enzyme (EGL).

30723 (SERI/SP–231-3245 B.220-B.238) **Enzyme production on cellulose/xylose mixture.** Mohagheghi, A.; Grohmann, K.;

Wyman, C. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Cellulase production by the RUT C-30 mutant of the fungus Trichoderma reesei was studied on mixture of xylose and cellulose, both in batch and fed-batch system. In mixed substrates, the lag phase of the growth cycle was shorter, and reached the maximum of total productivity in a shorter time, compared to growth on the single substrate, cellulose. A diauxic pattern of utilization of the two carbon sources was observed as well: xylose was utilized first to support growth, followed by cellulose to induce the cellulase enzyme production and provide an additional carbon source for cellular metabolism. Of the various mixtures of xylose and cellulose used in batch enzyme production, a ratio of 30:30 g/l of xylose to cellulose was optimal. This mixture produced the highest maximal enzyme productivity of 122 IFPU/l/hr, and its total productivity reached a maximum value of 55 IFPU/l/hr in less time than others. However, similar total productivities and higher enzyme titers were observed for growth on cellulose alone. In the fed-batch system, a start up mixture of 30:20 g/l xylose to cellulose and in intermittent feeding mixture of 5:15 g/l/day xylose to cellulose produced the highest titer of enzyme activity of 12.5 IFPU/ml, and total productivity of 45.4 IFPU/l/hr.

30724 (SERI/SP–231-3245 B.239-B.248) **Enhancement of cellulase production of Trichoderma reesei in fluidized bed reactor.** Tengerdy, R.P. (Colorado State Univ., Fort Collins (USA)). Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Enhancement of cellulase production of Trichoderma reesei, Rut C-30 will be attempted in a liquid upflow fluidized bed reactor (LFBR). Fungal spores will be attached to lignocellulosic carriers, such as corncob, granulated wood particles or granulated processed cellulose, fluidized in the LFBR in the presence of xylose, providing optimal conditions for spore germination, cellulase induction and rapid hyphal development. The LFBR may be used as a first stage reactor for providing enzyme induced fungal biomass for cellulase production in other bioreactors, or it may be used as a continuously operated immobilized cell bioreactor. In this latter mode, the fluidized immobilized fungal cells may produce cellulase under optimal mass transfer conditions, the produced enzymes and potential inhibitory products are continuously removed from the reactor, thereby enhancing cellulase productivity. The performance of the LFBR will be compared with currently used batch stirred tank reactors.

30725 (SERI/SP–231-3245 B.249-B.257) **Optimization of cellulase productivity from Acidothermus cellulolyticus.** Shiang, M. (Colorado State Univ., Fort Collins (USA)); Linden, J.C.; Mohagheghi, A.; Tucker, M.; Himmel, M. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The production of cellulase activity by Acidothermus cellulolyticus was studied by using media of various substrate composition. Controlled (pH, temperature and dissolved oxygen) fermentations with 1.0, 0.5 and 0.25 (w/v) percent of cellobiose were analyzed for filter paper activity, reducing sugar and optical density as a function of time. Similar analyses of a fermentation with 0.1 (w/v) percent cellobiose and 1.0 (w/v) percent solka floc showed approximately 2X, 2X and 3X as much filter paper degrading activity as the three respective cellobiose fermentations.

30726 (SERI/SP–231-3245 B.258-B.270) **Improvements of enzymatic hydrolysis of cellulose: strain development of Trichoderma reesei.** Tsao, Y.M. (Lehigh Univ., Bethlehem, PA (USA)); Montenecourt, B.S. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Microbial cellulases are important of potential industrial application in the conversion of renewable biomass to glucose syrups. The cellulases of the mesophilic fungus Trichoderma reesei have been the most extensively studied. Recent advances in the biochemistry of cellulase enzymology, the mechanism of cellulose hydrolysis, strain improvement, molecular cloning and process engineering are bringing T. reesei cellulases closer to being a commercially viable route to cellulose hydrolysis. Although major advances have been made in the isolation of Trichoderma mutants, e.g. Rut-C30, RL-P37 and MCG-80, problems still exits which hinder commercialization. The four areas which the authors have identified are (i) continuing low specific activity of the crude cellulases; (ii) requirement of cellulose as an inducer for maximum cellulase production; (iii) low levels of -glucosidase and (iv) slow and low biomass accumulation, thereby inhibiting high productivity. They have selected MCG-80 as a parent strain from which to isolate further mutants which have overcome the above mentioned problems. NTG (nitrosoguanidine) and UV light have been used as mutagens in the process of mutagenization. Constitutive mutants have been isolated which produce enhanced levels of B-glucosidase activities when corn syrup is used as the carbon source. Efforts were also made to isolate protease negative mutants to better understand the complex cellulase system of Trichoderma reesei.

30727 (SERI/SP–231-3245 B.271-B.278) **Targeted modifications to the structure of Trichoderma reesei CBHII.** Barnett, C. (Genencor, Inc., South Francisco, CA (USA)); Berka, R.; Ward, M.; Shoemaker, S. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Genecor has recently begun a program with SERI to examine some aspects of cellulase structure-function with exo-1,4-B-D-cellobiohydrolase II (CBHII) derived from Trichoderma reesei. Two types of modified enzymes will be produced. The first type will address the question of which amino acid residues are involved in catalysis. It has been proposed which residues are important in catalysis and the authors are testing this hypothesis. The specific modifications will be made in the gene encoding CBHII using synthetic oligonucleotide, site-directed mutagenesis. Expression of native and modified rCBHII's will be accomplished by transformation in Aspergillus awamori. Milligram quantities of the rCBHII's will be generated for characterization studies. The second type of modification to CBHII structure will be to generate a smaller molecule which contains the putative substrate binding site and catalytic site. The latter portion of CBHII (the carboxy terminal end) will be omitted by deleting the 3' end of the gene beginning at the start of the third intron. This rCBHII will be expressed in their Aspergillus system and milligram quantities will be prepared for characterization studies.

30728 (SERI/SP–231-3245 B.38-B.49) **Effect of non-uniform temperature distribution on acid hydrolysis of Aspen hemicellulose.** Abasaeed, A.E. (Auburn Univ., AL (USA)); Lee, Y.Y.; Torget, R. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The thermal diffusivities of Aspen wood were experimentally determined. The data were incorporated into a theoretical model designed to study the effect of transient temperature variation within the solid substrate during acid catalyzed hydrolysis of hemicellulose (prehydrolysis). The kinetic and the modeling results were analyzed to assess the effect of particle size on acid hydrolysis of hemicellulose. Among the important findings was that as the chip size increases, the maximum attainable yield of xylose decreases and the reaction time at which the maximum yield occurs increases. This effect becomes more significant as the temperature and the acid level increases. Quantitative criteria were therefore established to show the effect of particle size on the yield and the reaction time at various reaction conditions.

30729 (SERI/SP–231-3245 B.50-B.56) **Cell wall mechanisms of resistance to enzymatic hydrolysis.** Soltes, E.J. (Texas A & M Univ., College Station (USA)). Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

As isolated polymers, celluloses are readily hydrolyzed by acids or cellulolytic enzymes to yield glucose, although only acids can readily access and hydrolyze cellulose in lignocellulose, the lignified

cell wall substance of plants. This research concerns mechanisms of plant cell wall resistance to attack by polysaccharide degrading enzymes, and more specifically a determination of the relative roles of hemicellulose (xylan) and lignin in the cellulose accessibility issue. The overall working hypothesis of this research effort is that topochemical considerations in fibrillar structure as well as hemicellulose content and orientation have not been fully credited for the resistance of lignified tissues to enzymatic hydrolysis. Initial research objectives are to: (1) develop a mild, chlorine dioxide-based, holocellulose procedure for aspen wood and wheat straw, which will produce research materials retaining as much as possible of the original hemicellulose of the parent substrates in chemically unaltered form; and, (2) subject the various prepared holocelluloses to cellulase/hemicellulase digestibility studies for preliminary assessment of the relative roles of hemicellulose and lignin in resistance of plant cell walls to enzymatic attack.

30730 (SERI/SP–231-3245 B.57-B.66) **Mechanisms of plant cell wall resistance to polysaccharide degrading enzymes: a study using nuclear magnetic resonance analysis.** Dale, B.E. (Colorado State Univ., Fort Collins (USA)); Schroeder, H.A. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

This research project is directed toward identifying the key features and mechanisms of resistance to hydrolysis of polysaccharides in hardwoods and agricultural residues. Selective mild treatments will be analyzed for their effects on chemical constituents of the cell wall using solid state carbon 13 nuclear magnetic resonance (NMR) analysis combined with cross polarization and magic angle spinning. These treatments will be intended to selectively remove lignin, xylan or acetyl groups individually or together. Treatment effects on the rate and extent of enzymatic hydrolysis of polysaccharides will be determined and the results correlated with NMR analyses to identify the key features of hydrolytic resistance in these lignocellulosic materials, the authors primary research objective. This paper presents a brief description of their experimental philosophy and plan as well as some preliminary NMR results.

30731 (SERI/SP–231-3245 B.67-B.76) **Effect of thermochemical pretreatment on the enzymatic hydrolysis of lignocellulosic substrates I.** Converse, A.O. (Dartmouth College, Hanover, NH (USA)); Burns, D.S. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

A kinetics study has shown that the effect of pretreatment cannot be explained in terms of increased pore volume alone. Furthermore, knowledge of the variation in surface area as the enzymatic hydrolysis proceeds is needed to develop a kinetics model. A project has recently been initiated in order to determine the necessary data and refine the kinetics model. Recently determined pore size data for Avicel and Japanese rice straw are included.

30732 (SERI/SP–231-3245 C.24-C.31) **Overproduction of xylose isomerase and control of xy1A copy number in large-scale fermentations of Escherichia coli.** Spencer, T. (Virginia Polytechnic Institute and State Univ., Blacksburg (USA)); Potts, M. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Cells of Escherichia coli have been transformed with the plasmids pTXI-1 and pRK248. Plasmid pTXI-1 contains a copy of the gene which encodes xylose isomerase (xy1A) and the strong promoter P_L from bacteriophage Lambda. Plasmid pRK248 contains cI857 from Lambda which encodes the temperature-sensitive repressor promoter function. Upon temperature upshift from 32°C to 42°C cultures E. coli (pTXI-1/pRK248) are induced for massive overproduction of xylose isomerase. The enzyme converts non-fermentable xylose to xylulose - a sugar which can be fermented readily to ethanol. The objectives of this study are to resolve the major problems associated with overproduction of xylose isomerase in E. coli. These include, at the molecular level, the reversion and recombination of cI857 and fluctuation in plasmid copy number, the variation in enzyme stability (biochemical level) and, at the physiological level, the need to maintain growth of cultures at high-cell density.

30733 (SERI/SP–231-3245 C.32-C.39) **Cloning of the xylulokinase gene for improved yeast xylose fermentation. I.Cloning the yeast xylulokinase gene by complementation of E. coli xylulokinase mutation.** Ho, N.W.Y. (Purdue Univ., West Lafayette, IN (USA)). Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Recently it has been implied that yeast xylulokinase may play a significant role in the regulation of xylose metabolism in yeasts. A 7.3 kilobase (kb) fragment cloned on YEp13, a yeast–E.coli shuttle plasmid, was found capable of complementing E. coli xylulokinase mutations. Through restriction analysis and subcloning, the yeast xylulokinase structural gene has been localized on a 2 kb XhoI fragment near the 5' terminal of the cloned fragment and the orientation of the cloned gene has also been determined. Furthermore, the cloned gene most likely is dependent on a plasmid-borne promoter for its expression in E. coli.

30734 (SERI/SP–231-3245 D.1-D.15) **Lignin conversion - an overview.** Chum, H.L. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

Lignins are complex amorphous polymers which contain 30%-40% of the heat content in woody feedstocks. Biomass pretreatment alters chemical composition and properties of the resulting lignins. The aromatic complex nature of lignins suggests that they can be converted into mixtures of low-molecular-weight compounds that could be excellent liquid fuels. Various approaches could be used in this conversion. For instance, a mild hydrodeoxygenation and dealkylation leads to a mixture of substituted phenolic compounds and aromatic hydrocarbons as main products. The phenolics can be converted into methyl aryl ethers (MAE). The mixture of MAE and aromatic hydrocarbons has a high value as a low-vapor pressure octane enhancer that is fully compatible with gasoline. Other routes of conversion are possible. Because of the complexity of lignins, it is the authors strategy to produce mixtures of acceptable products such that separation costs that have plagued lignin utilization for one product routes are minimized. An integral part of lignin conversion into liquid fuels is lignin characterization which helps identify feedstock characteristics that make them most suitable for biochemical conversion. The characterization studies identify key chemical structures present in the lignins after pretreatment which have to be modified to transform these low-molecular-weight polymers into liquid fuels. Extractives and other bark-derived materials are isolated with the lignins after chemical modification in the pretreatment step and will be processed with lignins.

30735 (SERI/SP–231-3245 D.16-D.32) **Catalyst development for hydrodeoxygenation and dealkylation of lignins for fuels.** Ratcliff, M.A.; Chum, H.L.; Maholland, M.K.; Cowley, S.C. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The addition of phosphate, even in small amounts, has a significant effect on the properties of the support material of heterogeneous catalysts. The surface area passes through a maximum at a P/Al ratio of 0.1 before decreasing continuously with an increase in the P/Al ratio. The supports have unimodal pore distributions with the median pore size increasing with increasing P/Al ratio. An increase in the P/Al ratio results in material with a decreasing order of crystallinity, as evidenced by x-ray diffraction. The absence of alumina or aluminum phosphate crystals indicates that the supports are randomly arranged composite material rather then intimately mixed domains of alumina and aluminum phosphate. The addition of phosphate to catalysts prepared by this method has a marked affect on the catalyst activity and selectivity. The catalyst screening with 4-propylguaiacol (4PG), a lignin model compound, has shown that the formation of phenolic compounds suitable for conversion to methyl aryl ethers for fuels is possible. A Ni-Mo catalyst having a phosphated alumina support (P:Al = 0.5) gave the highest yields of

these compounds with hydrocarbons as the major side products. Initial tests with Mo catalysts suggest that the side product hydrocarbons can be biased in favor of aromatic hydrocarbons, which are more desirable as high-octane-fuel components and because they will consume less hydrogen in a lignin-to-liquid fuels process than the formation of cycloparaffins would. The Mo catalysts with phosphated alumina supports P:Al = 0.5 and 0.8 will be tested next to determine if higher selectivities to phenols, cresols, ethylphenols, etc., are possible while suppressing aromatic ring saturation as the results at P:Al = 0.2 suggest. The best catalysts will then be synthesized in larger quantities and tested with pretreated lignins in the authors parallel reactor engineering task.

30736 (SERI/SP–231-3245 D.33-D.52) **Lignin characterization - a summary progress report.** Chum, H.L.; Johnson, D.K.; Black, S.; Ratcliff, M. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The objective of this task is the chemical characterization of lignins produced in biomass processing–primarily biomass-to-liquid fuels such as ethanol. This report summarizes selected work carried out in collaboration with several researchers. The areas addressed are: (1) Quantitative structural information on aspen lignins produced in organosolv pretreatment. (2) Structural information on lignins produced by dilute acid hydrolysis of aspen followed by an alkaline delignification. (3) Lignin quantitation by nondestructive methods and comparisons of these methods with conventional techniques. (4) The preparation and characterization of lignin model polymers to further the understanding of lignin structure. For instance, the well-defined model compounds up to 1600 molecular weight and the synthetic lignin model polymers of up to about 10,000 can be used as appropriate calibration standards for the characterization of molecular-weight distributions of lignin polymers in the low-molecular-weight range. The molar volumes of these lignin model polymers and pertinent low-molecular-weight phenolic compounds were determined. (5) A summary of additional work now in progress is given.

30737 (SERI/SP–231-3245 D.53-D.64) **Design and testing of an autoclave system for lignin hydrotreating.** Johnson, D.K.; Chum, H.L.; Anzick, R.; Baldwin, R.M. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. In *FY 1987 biochemical conversion/ alcohol fuels program. Annual report.* Order Number DE89000831/JAW. Available from NTIS, PC A23/MF A01; 1.

The objective of this task to prepare a system in which catalysts, found effective in the conversion of lignin model compounds into low-molecular-weight phenols, suitable as feedstocks for methyl aryl ethers, can be tested with lignins. A stirred autoclave system has been built that incorporates the most important features found in the literature for the effective hydrotreating of lignin into low-molecular-weight phenolics. An injection system is included that allows lignin suspensions to be input into the autoclave preheated to hydrotreating temperatures. The collection system is set up so that volatile products may be swept from the autoclave to prevent their possible further reaction. The autoclave system has been tested with lignins using a hydrogenolysis reaction. Injection of aqueous lignin suspensions into the preheated autoclave worked well. The system operated well at high temperature and at pressures far in excess of those necessary for hydrotreating. A lignin-derived oil was produced in good yield from experiments lasting 5 and 20 minutes. The oils were phenolic in nature and may possibly be used as pasting oils in the future.

30738 (SERI/TR–213-3472) **SERI results from the PEP 1987 Summit Round Robin and a comparison of photovoltaic calibration methods.** Emery, K.A.; Waddington, D.; Rummel, S.; Myers, D.R.; Stoffel, T.L.; Osterwald, C.R. Solar Energy Research Inst., Golden, CO (USA). Mar 1989. 82p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000896/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The SERI results for the Photovoltaic Solar Energy Project (PEP) 1987 summit round robin are presented and the proposed International Electrotechnical Commission (IEC) technical committee TC82 global calibration method is evaluated in this report. The global calibration method has a ±4% uncertainty in the short-circuit current (I_{sc}) including random and nonrandom error sources. This uncertainty can be reduced ±3% if the global normal method is used and the direct component of the total irradiance is measured with a primary absolute cavity radiometer. Nearly half of the uncertainty for various primary and secondary PV calibration methods is nonrandom. If a ±4% uncertainty in I_{sc} under standard reporting conditions is acceptable, then the global calibration method with spectral corrections is suitable for cells or modules. If a primary reference device with an uncertainty less than ±3% is required, then the global method is unsuitable. The SERI primary direct normal calibration method has a ±1% uncertainty in I_{sc} as verified by comparison with primary AMO cells. If a ±1% primary reference cell is used for secondary calibrations, then a ±2% uncertainty could be achieved for reference cells or modules. 37 refs., 29 figs., 42 tabs.

30739 (STEV-EO–89-1) **Energy forest south. Progress report 1987-1988.** Toerner, L. Statens Energiverk, Stockholm (Sweden). Aug 1988. 22p. (In Swedish). Order Number DE89766887/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Evaluation of 30 test plantations are presented. Planting on clay soils and weed control demand further efforts. Development of harvesting equipment is discussed. (G.B.).

30740 (STEV-EO–89-3) **Energy forest east. Progress report 1987-1988.** Johansson, L. Statens Energiverk, Stockholm (Sweden). Sep 1988. 21p. (In Swedish). Order Number DE89766888/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Cultivation of energy forest on farming soil is feasible at a reasonable cost. Planting equipment is available and fertilizing should be paid attention to. Mineral soils give good results when weed is taken care of. 17 cultivation places have been evaluated, the total area being 71.5 hectares. (G.B.).

30741 (STEV-EO–89-6) **Testing station at Soesdala. Experiments concerning energy forest on organogenic soil (exploited peatland).** Ohlsson, T. Statens Energiverk, Stockholm (Sweden). Apr 1988. 118p. (In Swedish). Order Number DE89766926/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

The results show that a high production of energy forestry can be achieved on this type of soil. It is of major importance to create an enlarged active root volume. Experiments have also shown that addition of micronutrients increases the biomass production. Various trials demonstrate that Salix is very sensitive to competition from weeds and other crops. Severe production losses have been caused by the beetle Phratora vulgatissima. Various forms of stem damage probably due to fungi have also been observed on some clones. Suitable cultivation methods are recommended. (G.B.).

30742 (STEV-FGT–89-1) **Bark gasification at Vaeroe bruk.** Lindman, N. Statens Energiverk, Stockholm (Sweden). 1989. 23p. (In Swedish). Order Number DE89766927/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Goetaverken Energy has developed a process of bark and forest fuel gasification in order to replace oil for the lime kilns of pulp industry. The total efficiency of the plant was 86% and its cost MSEK 68.75. The operation has not been as profitable as calculated but the availability is improving. (G.B.).

30743 (STF–34A88072) **Electrochemical conversion of solar energy.** Hagen, G. Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Jul 1988. 50p. (In Norwegian). Order Number DE89766872/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The report contains a short survey on energy perspectives. The importance of using "renewable" energy sources such as solar cells is discussed. Principles and results from conversion of solar energy in photochemical cells are discussed as well as advantages and disadvantages of this method compared to "ordinary' solar cells from pn-Si semiconductor compounds. The importance of expert development on conversion and storage of solar energy is underlined in order to in the near future meet the needs for a more

extensive utilization of solar energy. The report suggests concentrating on development and use of new types of electroactive, organic polymer materials. 7 tabs., 23 figs., 48 refs.

30744 Plasma deposition of hydrogenated amorphous silicon films. Luft, W. (Solar Energy Research Institute, Golden, CO (USA)); Tsuo, S. *Applied Physics Communications (USA)*, 8(1): 1-74 (Mar 1988). DOE Contract AC02-83CH10093.

Plasma-assisted chemical vapor deposition has become the most common technique used in the deposition of hydrogenated amorphous silicone films and devices for photovoltaic applications. The purpose of this paper is to summarize aspects of glow discharge relevant to the deposition of high-quality hydrogenated amorphous silicon materials and to elucidate the effects on these films and devices of various deposition parameters and other aspects of the growth process, to better understand how the films are formed. Such a basic understanding is important, because the empirical optimization of these devices' electronic properties has become increasingly more difficult as the device structures become more complex.

30745 High-rate deposition of hydrogenated amorphous silicon films and devices. Luft, W. (Solar Energy Research Institute, Golden, CO (USA)). *Applied Physics Communications (USA)*, 8(4): 239-298 (Dec 1988). DOE Contract AC02-83CH10093.

In high-rate deposition of a-Si:H films, the effect of deposition parameters on material properties are examined when silane and disilane are the feed gases. The emphasis is on RF glow discharge, but other deposition methods are also covered. The problems of gas-phase polymerization and power formation at high rates have been overcome by modified reactor designs. Deposition rates of 1-3 nm/s are adequate for economically fabricating the intrinsic layer. Laboratory-size a-Si:H cells with greater than 10% efficiency have been achieved with both silane and disilane at rates in the 1- to 2-nm/s range.

30746 Theory of photoinduced intramolecular electron transfer in condensed media. Lin, S. H. (Department of Chemistry and The Center for the Study of Early Events in Photosynthesis, Arizona State University, Tempe, Arizona 85287-1604(US)). *Journal of Chemical Physics (USA)*, 90(12): 7103-7113 (15 Jun 1989).

In this paper, we are concerned with the theoretical treatment of intramolecular electron transfer (ET). In particular we are interested in the effect of the chemical groups connecting between donor and acceptor groups on electron transfer. We treat two cases. Type 1 refers to the situation where the energy difference between the LUMO of the connecting groups and the LUMO of the donor group is much larger than vibrational energies. Type 2 refers to the situation where the energy difference between the LUMO of the connecting groups and the LUMO of the donor group is comparable to vibrational energies. We show that Type 1 ET is similar to the Raman scattering while Type 2 ET is similar to the resonance Raman scattering.

1406 Photovoltaic Power Systems

Refer also to citation(s) 30709

30747 (SAND–88-7036-Pt.1) **PVREG – a photovoltaic voltage regulation investigation tool: PVREG user's manual.** Garrett, D.L.; Sims, T.R.; Jeter, S.M.; Jones, R.A. Sandia National Labs., Albuquerque, NM (USA); Southern Electric International, Atlanta, GA (USA); Georgia Inst. of Tech., Atlanta, GA (USA). Jun 1989. 144p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE89013346/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This manual provides essential information for operating the computer program PVREG, a program developed to study the impact of distributed photovoltaic (PV) systems on the voltage regulation of distribution systems. The simulation consists of detailed models of the distribution system's components and a model of solar insolation and cloud systems based on typical meteorological year data. The response of the voltage regulating devices to changes in PV system outputs due to moving cloud systems is determined in discrete time steps. The number of operations of each voltage regulating device is determined, along with the feeder voltage profile. The program structure and a brief description of the models are given. A benchmark case is included to illustrate the use of the various program models.

30748 (SAND–88-7036-Pt.2) **PVREG - A photovoltaic voltage regulation investigation tool: Program reference manual.** Garrett, D.L.; Sims, T.R.; Jones, R.A.; Jeter, S.M. Sandia National Labs., Albuquerque, NM (USA). Jun 1989. 89p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE89013333/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This manual provides information for installing and maintaining the computer program PVREG, a program developed to study the impact of distributed photovoltaic systems on the voltage regulation of distribution systems. The manual describes installation on the Apollo workstation or the IBM PC-AT (or compatible), but the instructions and code description should be general enough to assist installation on other computers, also. The manual assumes that the user is well acquainted with the computer on which the program is to operate and with the operating system of that computer. The manual describes the program structure and models in detail and provides step-by-step installation instructions for both the Apollo and AT-compatible computers. 9 figs., 11 tabs.

30749 (SAND–88-7042) **Islanding in dispersed, utility-interactive photovoltaic systems.** Ranade, S.J.; Prasad, N.R.; Omick, S.R. Sandia National Labs., Albuquerque, NM (USA). May 1989. 169p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE89013330/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This report deals with the analysis of "islanded" operation in electric utility-connected, residential photovoltaic systems. Islanding is a phenomenon in which several such systems continue to operate and, together, keep the electric distribution system energized even after the primary source is disconnected. Such operation presents a hazard to utility and other personnel. We show how islanding can be studied using a combination of a power-flow- analysis-like method, an examination of large-signal limit-cycle behavior, and small-angle stability analysis that can account for control system response. The methodology is validated to a limited extent through simulation and testing. Studies conducted using the developed methods suggest that, although islanding is intrinsic to all systems, normal load variation, inverter protective mechanisms, voltage/frequency relays, and destabilizing feedback controls effectively limit the practical possibility of islanding. 14 refs., 63 figs., 2 tabs.

1407 Solar Thermal Power Systems

Refer also to citation(s) 30709

30750 (NEI-DK–169) **Experimental investigation of regulating systems for combinations of solar collectors and heat pumps.** Martens, P.; Munter, P. Teknologisk Inst., Taastrup (Denmark). Afd. for Varme-og Installationsteknik. Apr 1986. 74p. (In Danish). Order Number DE89776134/JAW. Available from NTIS (US Sales Only), PC A04/MF A01;1.

If energy from a solar collector is transported to a heat pumpe a more efficient utilization of solar energy results when the temperature of the solar collector is higher than that of the soil. Because of high sensitivity to temperature it is important that installations are meticulously regulated in order to obtain optimal efficiency and thus reduce costs to a minimum. Possibilities are many for variations in component combinations in such installations. Thus various forms of regulatory strategies and their influence on energy economy have been examined in detail. (AB).

30751 (SAND–88-3027C) **A preliminary assessment of the effect of sunshape on the performance of central receiver systems.** Menicucci, D. Sandia National Labs., Albuquerque, NM (USA). [1988]. 3p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-890610–1: ASES annual meeting and 14th annual passive solar conference, Denver, Colorado, USA, 19-23 Jun 1989). Order Number DE89003912/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

CENTRAL RECEIVERS/performance; PERFORMANCE; D CODES; DESIGN; EFFICIENCY; HEAT LOSSES; SOLAR EQUIPMENT

30752 (SAND–89-0424C) **16th inter-ram conference for the electric power industry.** Kolb, G.J.; Lopez, C.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-890548–1: 16. conference for the electric power industry: reliability, availability, maintainability, Monterey, California, USA, 24-25 May 1989). Order Number DE89007639/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Solar One is the world's largest central receiver power plant. During the last 4 years the plant availability was 80%, 83%, and 96%, respectively, during hours of sunshine. This reliability is considered to be excellent considering the plant is a first-of-a-kind facility and because it has been subjected to daily cyclic service. In this paper we present the frequencies and causes of the plant outages that occurred. The ten most important causes comprised 72% of the total outage time. Qualitative insights related to the cause and mitigation of these ten are provided. The information presented in this paper will be useful to studies aimed at improving the reliability of future solar central receiver power plants. It is also useful to members of the utility industry who are considering investing in this technology or are considering cyclic operation of conventional power plants. 4 refs., 3 figs.

30753 (SAND–89-0463) **Proceedings of the annual solar thermal technology research and development conference.** Couch, W.A. (ed.). Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 269p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-8903117–Vugraphs: Annual solar thermal technology research and development conference, Arlington, Virginia, USA, 8-9 Mar 1989). Order Number DE89010538/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

The Annual Solar Thermal Technology Research and Development Conference is being held at the Holiday Inn Crowne Plaza in Arlington, Virgina, Marh 8 and 9, 1989. This year the conference is meeting in conjunction with SOLTECH '89. SOLTECH '89 is a jointly sponsored meeting of the Solar Energy Industries Association, Interstate Solar Coordination Council, Sandia National Laboratories and the Solar Energy Research Institute. This report contains the agenda, extended abstracts and most significant visual aids used by the speakers during the Solar Thermal Technology research and development sessions. The program is divided into three sessions: Solar Electric Technology, Non-Electric Research and Development and Applications, and Concentrators.

1409 Solar Thermal Utilization

Refer also to citation(s) 30753, 30950

30754 (NP–9774848) **Optimization of the tobacco-drying process with respect to possible applications of solar radiation.** Morhenne, J. Bochum Univ. (Germany, F.R.). Fakultaet fuer Maschinenbau. 19 Feb 1987. 135p. (In German). Order Number DE89774848/JAW. Available from NTIS (US Sales Only), PC A07/MF A01;1.

The study discusses the drying process of tobacco and the extent of its influence on factors determining quality both in respect of a process with a better use of energy and with a view to the possible applications of the thermal use of solar radiated energy. The study aims to provide information on the extent to which the drying process can be adapted to the requirements of thermal solar energy use, so that the product's quality is not altered. A feature of the market of some significance is the fact that the demand for light tobaccos is continually increasing, and they have up till now been produced in industrial drying processes with a high expenditure of energy, therefore have not been accessible to solar energy use.

30755 (SLU-LBT–63) **Light reduction regarding to the greenhouse construction. Average transmission factor for direct light through the greenhouse roof.** Nilsson, G. Swedish Univ. of Agricultural Sciences, Lund. Dept. of Farm Buildings. Oct 1988. 68p. (In Swedish). Order Number DE89766896/JAW. Available from NTIS (US Sales Only), PC A04/MF A01;1.

The purpose of the present study was to develop a computer model for calculating the average transmission for direct light through a greenhouse roof. The model is supposed to be a part in a computer model for simulating greenhouse climate. The main purpose of this extended model is to calculate the effect of a change in outdoor climate on the indoor greenhouse climate, when the climate control is not in use. As a starting-point for the study, an existing model for a Venlo greenhouse roof has been used. Bot's model is based on the concept that edge effects may be eliminated along the sides in a large greenhouse In addition to Bot's model, the present study presents equations that take into consideration the edge effects along the walls of a greenhouse. Bot's model excludes the effect of any construction parts or heating pipes. However, the equations presented in this study calculate the transmission with regard to these details. The edge effect has been taken into consideration for the heating pipes but not concerning the construction The model stresses the importance of the edge effect at low sun altitudes. At low sun altitude the average transmission value for the first span in a multispan greenhouse can be about 55 % and in the fourth only 25 %. At higher altitudes the transmission value can be lower in the first span compared to the others This means that if Bot's model is used for a single greenhouse or a small multispan greenhouse the result will give too low values for low sun altitudes and too high values for higher altitudes. The difference between the models are not only dependent of the sun altitude. The number of spans are also a factor to be taken into consideration as the edge effect will be of less importance when the number of spans increase.

1410 Solar Collectors and Concentrators

Refer also to citation(s) 30751

30756 (DFVLR-FB–87-29) **Performance of highly concentrating mirror collectors and collector systems.** Koehne, R.; Kleih, J. Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.); Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V. (DFVLR), Stuttgart (Germany, F.R.). Inst. fuer Technische Thermodynamik. 1987. 68p. (In German). Order Number DE89774606/JAW. Available from NTIS (US Sales Only), PC A04/MF A01;1.

The concentration ratio of focussing solar collectors and collector systems has a relevant influence on the thermal efficiency which is strongly influenced by errors of the mirror surfaces (σ-value). In addition to geometric calculations of the concentration ratios of parabolic, spherical mirrors and mirror systems including secondary concentrators HELIOS code calculations were carried out to determine the radiant flux density distribution depending on different σ-values. For σ-values between 1.5 and 6 mrad ratios between 1000 to 8000 and 600 to 2000, resp., were obtained for parabolic mirrors and spherical mirrors. The maximum thermal efficiencies range from 80 to 55% for receiver temperatures between 400 and 800/sup 0/C. (orig.) With 29 figs., 6 tabs., 23 refs.

30757 (NEI-DK–171) **Inexpensive selective absorber produced in Denmark.** Christensen, P.; Kier Nielsen, J. Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark). Feb 1989. 43p. (In Danish). Order Number DE89776137/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Explanation of the production process for selective absorbers made primarily of copper piping strips for solar collectors. Detailed descriptions of the finished products are presented and illustrated with charts and diagrams. (AB).

30758 (SERI/TP–254-3453) **Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems.** Pesaran, A.A.; Bingham, C.E. Solar Energy Research Inst., Golden, CO (USA). Dec 1988. 7p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-890436–11: American Society of Mechanical Engineers solar energy conference, San Diego, California, USA, 2-6 Apr 1989). Order Number DE89000842/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Four experimental test facilities for characterizing the performance of solid desiccant materials and dehumidifier matrices which have the potential to be used in solar-regenerated desiccant cooling systems are reviewed. The water equilibrium capacity and sorption rates of desiccant materials, depending on their form, can be either

measured with a quartz crystal microbalance or a desiccant sorption test facility. Pressure drop, heat- and mass-transfer rates and transient equilibrium dehumidification capacity of a dehumidifier matrices are measured in a desiccant heat and mass transfer test facility. The performance and steady state dehumidification capabilities of prototype dehumidifier components under realistic conditions are measured in a desiccant cyclic test facility. The description of the test apparatus, experimental procedure, measurement errors, and typical results for the four test facilities are presented here. 15 refs., 9 figs., 1 tab.

30759 (SV-UL–1988-34) **Influence of convection on the temperature distribution and heat losses of solar collectors.** Hellstroem, B. Swedish State Power Board, Aelvkarleby (Sweden). 26 Sep 1988. 24p. (In Swedish). Order Number DE89766897/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Examination paper.

In flat thermal collectors heat losses are partly caused by natural convection of the air between the absorber and the glazing. Experimental studies of this effect in a collector model are reported. (L.E.).

15 GEOTHERMAL ENERGY

1501 Resource Status and Assessment

30760 (DOE/ID/12693–2, pp. 23-44) **Nature of geothermal resources.** Wright, P.M. (Univ. of Utah Research Institute, Salt Lake City (USA)); Culver, G. Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

Geothermal energy is heat that originates within the earth. At our current stage of technology, economic development of geothermal heat can be accomplished in a few areas where the heat is concentrated by geological processes. Approximately 5000 megawatts of electricity (MWe) are currently being generated in 176 countries from geothermal energy, and 10,000 thermal megawatts (MWt) are being used for direct heat applications. The US produces 2112 MWe of electrical power and uses 1700 MWt in direct applications. While this is small compared to their use of an estimated 8.4 million MW of fossil energy, it nevertheless saves the consumption of 130 million barrels of oil/y worldwide and 47 million barrels/y in the US. It is difficult to estimate the ultimate potential contribution of geothermal energy to mankind's needs for three reasons: (1) Future energy costs are uncertain, and many lower-grade geothermal resources would become economic at higher energy prices; (2) Only preliminary estimates of the worldwide resource base have been made; (3) Technology is not yet available for the economic use of magma, hot rock, geopressured and normal thermal-gradient resources, whose potential contributions are large.

1502 Geology and Hydrology of Geothermal Systems

30761 **An experimental study of hydroxyl in quartz using infrared spectroscopy and ion microprobe techniques.** Rovetta, M. R. (Geophysics, Los Alamos National Laboratory, Los Alamos, New Mexico(US)); Blacic, J. D.; Hervig, R. L.; Holloway, J. R. *Journal of Geophysical Research (USA)*, 94(B5): 5840-5850 (10 May 1989).

We have measured the concentrations of hydroxyl, deuterium, Al, Fe, Li,Na, K, and Rb in a natural quartz crystal before and after hydrothermaltreatment at 1.5 GPa and 800°–1050 °C. We employed microbeam infraredspectroscopy and ion probe techniques to avoid impurities trapped in healedcracks and fluid inclusions that might bias a normal bulk analysis.The f_{H_2} of our experiments were buffered to thehematite-magnetite-(OH)fluid, nickel-nickel oxide-(OH)fluid, oriron-wustite-(OH)fluid phase assemblages. After hydrothermal treatment,the samples contained local concentrations of hydrogen or deuterium ofseveral hundred atoms/10^6 Si (the starting crystal contained 45 H/10^6 Si).We did several experiments with Al_2O_3 or RbCl added to the sample chargeand found local Al enrichment where the deuterium concentration was highbut no Rb enrichment. Finally, we measured trace elements and hydroxyl in aquartz sample after plastic deformation in a talc furnace assembly; inregions of the sample containing basal and prismatic deformation lamellae(but no visible healed microcracks at 400× optical magnification)hydroxyl had increased to ~200 oO/10^6 Si with no increase in Al or Fe.Samples enriched in hydroxyl but not Al (including the plastically strainedsample) gave infrared spectra resembling natural amethyst crystals.

1503 Geothermal Exploration and Exploration Technology

30762 (DOE/ID/12693–2, pp. 45-80) **Exploration for direct heat resources.** Wright, P.M. (Univ. of Utah Research Institute, Salt Lake City (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

Geothermal exploration may be divided into two types: (1) Exploration for geothermal resources, that is, locating new geothermal resources; (2) Exploration within geothermal resources, that is, defining the lateral and vertical boundaries and the internal properties of the reservoir. In each case, one objective of the exploration work is to site wells that intersect the resource. Because drilling is usually expensive and because the present economics of most direct-heat applications will not support an extensive exploration program, it is important to design and execute exploration programs in the most efficient way possible. Many earth science techniques are applicable both to exploration for and exploration within geothermal systems, and in the discussion that follows, examples of both types of exploration are given. The purpose of this chapter is to outline the principal methods used in geothermal exploration, how exploration strategies are devised, and the costs for typical exploration programs. The methods and techniques considered can be grouped under the general headings of geological methods, geochemical methods and geophysical methods. Techniques for study of resources of all temperatures are considered, with emphasis on low- and moderate-temperature resources because these are the ones usually considered for direct applications. 42 references.

30763 (DOE/ID/12693–2, pp. 81-94) **Geothermal fluid sampling techniques.** Kindle, C.H. (Pacific Northwest Labs., Richland, WA (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

The purpose of sampling and analysis of a geothermal fluid is to determine the chemical and isotopic constituents. Because most geothermal direct use projects operate with fluid temperatures less than boiling, this chapter only applies to sampling these lower temperature fluids. Data on fluid characteristics can be applied to: (a) process design, (b) materials selection, (c) plant operation and maintenance, and (d) reservoir evaluation. Depending upon the purpose and nature of the study, changes in samples, upon collection and storage, may or may not be a problem. The information needed for a particular study and the desired accuracy should be established first; then, the appropriate sampling techniques can be selected. This chapter suggests sample treatment (stabilization) and field analysis techniques appropriate for minimizing errors (that may result from changes in water samples between time of collection and time of analysis). Methods for analysis of the samples in the laboratory are given in standard reference publications and are not covered in this chapter. A combination of standard techniques and commercially available instruments generally used by laboratories are: spectroscopy - for cations; ion chromatography - for anions; colorimetry - for silica and ammonia; selective ion electrode - for ammonia; titrations - for sulfide, alkalinity, hardness, CO_2 and chloride; turbidimetric - for sulfate; and gravimetric - for suspended and dissolved solids. Preservation of a sample is often a problem; constituents may precipitate out, undergo chemical change, or evolve as a gas. Most sample constituents can be stabilized in the field for analysis in the laboratory. Analysis should take place as soon as possible.

30764 (ITL–8509, pp. 138-143) **Monitoring of hot water plume movements in an aquifer with borhole/surface resistivity**

measurements. Tsang, C.-F. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA); Wilt, M.J. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905--: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG--89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In this study, a simulation of a downhole/surface resistivity experiment to map a hot water plume was performed using a three-dimensional computer code. A fixed amount of hot water was placed in an aquifer between 45 and 70 m below ground surface and resistivity measurements were made at the surface using a current electrode in the hot water body. Results indicate that the anomaly is much greater using the downhole electrode than for surface arrays and that the data may be used for rough characterization of the hot water mass and its boundaries. Several cases involving different plume boundaries were studied and results indicate that the downhole/surface measurements are not very sensitive to differences in the boundary geometry, although a rough determination of the boundary position is possible. For the case where the hot water plume is moving relative to the downhole current electrode until it completely leaves the electrode behind, the anomaly size is smaller but the shape allows for good discrimination of the near-side boundary. 3 refs., 3 figs.

1504 Legal and Institutional Aspects

30765 (DOE/ID/12693–2, pp. 361-392) **Regulatory and commercial aspects.** Bloomquist, G. (Washington State Energy Office, Olympia (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

To a large extent, the regulatory and commercial aspects of geothermal development have been addressed, in varying degrees, by the US Congress and by the legislatures of each of the states known to possess geothermal resources. Often the conclusion reached, and the direction given by these agencies, has been significantly different. Too often the legislation has left as many questions unanswered as answered, or created as many new problems as were resolved. In some unfortunate cases, the legislation has, in fact, proven to be more of an obstacle toward development than an aid. This chapter provides an overview of the various regulatory and commercial aspects that affect the development of geothermal direct use projects. Appendix A provides pertinent geothermal definitions, ownership, and leasing information, injection requirements and the agencies involved. Information is provided for the federal government, Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, North and South Dakota, Oregon, Texas, Utah, Washington, and Wyoming.

1505 Economic and Financial Aspects

Refer also to citation(s) 30783

1506 Environmental Aspects and Waste Disposal

30766 (BNL–42663) **Developments in geothermal waste treatment biotechnology.** Premuzic, E.T.; Lin, M.S. Brookhaven National Lab., Upton, NY (USA). 1989. 5p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-76CH00016. (CONF-8903124–1: Geothermal program review meeting, Washington, D.C., USA, 15 Mar 1989). Order Number DE89011902/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Extensive laboratory studies have indicated that the application of biochemical processes in the development of biotechnology suitable for conversion of geothermal wastes from hazardous to nonhazardous materials is technically and economically feasible. These studies have also shown that such biotechnology may require bioreactors capable of handling different amounts and types of residual sludges. Particular attention has to be paid to the duration of treatment, efficiency of cycling, and maintenance of biomass. Laboratory studies addressing these parameters are described. 7 refs., 8 figs.

30767 (DOE/ID/12693–2, pp. 393-401) **Environmental considerations.** Lunis, B. Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

The degree to which geothermal development affects the environment is, in most cases, proportional to the scale of such development. For example, the environmental impacts associated with geothermal direct use projects are often minimal compared to those associated with large scale electrical generation projects. The direct use projects are often designed as closed loop systems where the low- or moderate-temperature geothermal fluids are circulated through a heat exchanger or heat pump (or flow naturally around downhole heat exchangers). The spent geothermal fluids are then injected into or near the producing aquifer, or surface discharged into nearby drainage and waterways or both. The surface discharge approach normally produces greater environmental concern than injection. These and other environmental considerations are addressed in this chapter. Regulations that may apply are also discussed.

1509 Geothermal Engineering

Refer also to citation(s) 30775

30768 (DOE/ID/12693–2, pp. 95-130) **Drilling and well construction.** Culver, G. (Geo-Heat Center, Klamath Falls, OR (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

Drilling and well construction (probably one of the most expensive features of a geothermal direct use project) is often the least understood. This chapter provides the basics of equipment and methods used for drilling and completion of geothermal wells. It provides data needed by architects, engineers, and consultants to assist them in specification writing, selection of contractors, and drilling and completion inspection. Most direct use geothermal wells can be drilled using conventional water well technology and equipment. Most of the wells will produce water at temperatures less than boiling and without artesian flow at the surface; however, some will be hotter or will flow. Blowout preventers and other sophisticated safety equipment are not usually required; however, this does not mean that there are not significant safety considerations that should be addressed. Many of the wells have water above 140°F and this will scald. Public and drilling crew safety must be ensured. The cementing portion may appear to be overly detailed and long. However, the authors's view is that, all too often, cementing is considered simply as a means of plugging up the annulus between the casing and bore hole wall. Little attention is paid to methods and materials, and a poor cement job is the result. This can result in lost production zones, cold water leaking into production zones, geothermal water leaking into freshwater zones, and reduced useful well life. Also, in view of the increasing awareness and concern about interzonal migration and possible fresh water aquifer contamination, proper cementing is of increasing importance.

30769 (DOE/ID/12693–2, pp. 131-148) **Well testing and reservoir evaluation.** Stiger, S.G.; Renner, J.L.; Culver, G. Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

This chapter presents a summary of the well testing and reservoir engineering techniques used to estimate the production potential of a geothermal system. The basic theory behind geothermal reservoir engineering and the influence of simplifying assumptions required to enable solutions to the basic flow equations are discussed. A summary of well testing methods and data acquisition considerations for geothermal systems is also included. The techniques that are summarized here have been developed from both groundwater and petroleum engineering disciplines. In recent years, the field of

geothermal reservoir engineering has emerged as a separate discipline that addresses those factors unique to geothermal systems. Low-temperature geothermal reservoirs more nearly approximate a groundwater aquifer than do higher temperature reservoirs and it is tempting to simply apply groundwater methods to analyze them. This approach can lead to significant errors in the analyses. The following sections highlight those features of geothermal reservoirs that should be considered during any evaluation of a geothermal system: reservoir engineering theory; conceptual reservoir models; well testing; data acquisition and instrumentation; data interpretation; caveats; and direct use injection wells.

30770 (DOE/ID/12693–2, pp. 167-200) **Well pumps.** Culver, G. (OIT Geo-Heat Center, Klamath Falls, OR (USA)); Rafferty, K.D. Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

There are basically two types of pumps for producing geothermal fluids, a lineshaft turbine pump and a submersible pump, either low- or high-temperature. These types are described in detail and pump pricing factors are discussed for both types. The paper then describes variable speed drives for geothermal applications, giving details on the following: multi-speed motors, wound rotor induction motor, variable frequency control, shaft-oriented control, calculation of speed requirements, and temperature increase considerations. Jet pumps, centrifugal pumps, and recirculation are also briefly described.

30771 (DOE/ID/12693–2, pp. 201-216) **Piping geothermal fluids.** Rafferty, K.D. (OIT Geo-Heat Center, Klamath Falls, OR (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

The source of geothermal fluid for a direct use application is often located some distance away from the user. This requires a transmission pipeline to transport the geothermal fluid. Even in the absence of transmission line requirements, it is frequently advisable to employ other than standard piping materials for in-building or aboveground piping. Geothermal energy for direct use applications is usually transported in the liquid phase and has some of the same design considerations as water distribution systems. Several factors including pipe material, dissolved chemical components, size, installation method, head loss and pumping requirements, temperature, insulation, pipe expansion and service taps should be considered before final system selection. Piping materials for geothermal heating systems have been of numerous types with great variation in cost and durability. The most common materials are carbon steel, ductile iron, fiber glass (RTRP), asbestos cement (AC), polybutylene (PB), chlorinated polyvinyl chloride (CPVC), polyvinyl chloride (PVC), and polyethylene (PE). The temperature and chemical quality of the geothermal fluids, in addition to cost, usually determines the type of pipeline material used. Figures introduce the temperature limitations and relative costs of the materials covered in this chapter. Generally, the various pipe materials are more expensive the higher the temperature rating. Installation costs are very much a function of the type of joining method employed and the piping material. The light weight of most nonmetallic piping makes handling labor significantly less than that of steel and ductile iron in sizes greater than 3 in.

30772 (LBL–26898) **Geothermal field case studies that document the usefulness of models in predicting reservoir and well behavior.** Lippmann, M.J. Lawrence Berkeley Lab., CA (USA). Mar 1989. 7p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-890352–8: US Department of Energy research and development for the geothermal marketplace: 7th geothermal program review, San Francisco, California, USA, 21-23 Mar 1989). Order Number DE89011820/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The geothermal industry has shown significant interest in case histories that document field production histories and demonstrate the techniques which work best in the characterization and evaluation of geothermal systems. In response to this interest, LBL has devoted a significant art of its geothermal program to the compilation and analysis of data from US and foreign fields (e.g., East Mesa, The Geysers, Susanville, and Long Valley in California; Klamath Falls in Oregon; Valles Caldera, New Mexico; Cerro Prieto and Los Azufres in Mexico; Krafla and Nesjavellir in Iceland; Larderello in Italy; Olkaria in Kenya). In each of these case studies we have been able to test and validate in the field, or against field data, the methodology and instrumentation developed under the Reservoir Technology Task of the DOE Geothermal Program, and to add to the understanding of the characteristics and processes occurring in geothermal reservoirs. Case study results of the producing Cerro Prieto and Olkaria geothermal fields are discussed in this paper. These examples were chosen because they illustrate the value of conceptual and numerical models to predict changes in reservoir conditions, reservoir processes, and well performance that accompany field exploitation, as well as to reduce the costs associated with the development and exploitation of geothermal resources. 14 refs., 6 figs.

1510 Direct Energy Utilization

30773 (DOE/ID/12693–2, pp. 1-6) **Introduction.** Lienau, P.J. (Geo-Heat Center, Klamath Falls, OR (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

The use of low- and moderate-temperature (50 to 300°F) geothermal resources for direct use applications has increased significantly since the late 1970s. As a result of this growth, and the need to have available state-of-the-art information for geothermal direct use project development for engineers, designers, and developers, this Guidebook was published. In 1979, Direct Utilization of Geothermal Energy: A Technical Handbook was published. Since that time a great deal of new information has been made available. Valuable information gained from operating experience on many projects has been included in this Guidebook. The technical content and the practicality of this Guidebook is more extensive. In 1977 and 1978, the US Department of Energy, Division of Geothermal Technology, issued Program Opportunity Notices that enabled the government to cost-share a significant portion of the high front-end financial risk with private and municipal developers in a variety of direct use projects. Many lessons were learned about institutional building heating projects, district heating systems, agribusiness projects, and industrial projects that were developed under the cost-shared program. These lessons and the information obtained from a multitude of other direct use projects provide the background for the Guidebook.

30774 (DOE/ID/12693–2, pp. 7-22) **Demonstration projects lessons learned.** Lunis, B.C. Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

The use of geothermal energy for direct use applications was aided through the development of a number of field experiment projects funded on a cost-shared basis by the US Department of Energy, Division of Geothermal and Hydropower Technology. Although not all of the projects became operational, they all provided significant observations that may help future developers from reinventing the wheel. This chapter provides a summary of the lessons learned about institutional heating projects, district heating systems, agribusiness projects, and industrial projects that were developed under the cost-shared program.

30775 (DOE/ID/12693–2, pp. 149-166) **Materials selection guidelines.** Ellis, P.F. III (Radian Corp., Austin, TX (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

The economic utilization of geothermal resources with temperatures < 220°F, for direct use, requires creation of systems with long plant life, minimum operation, and maintenance costs. Development of such systems requires careful corrosion engineering if the most cost effective material selections and design choices are to be made. This chapter presents guidelines for materials selection for low-temperature geothermal systems (120-220°F), as well as

guidance in materials design of heat pump systems for very-low-temperature geothermal resources (< 120°F). This chapter is divided into four sections: (1) Key Corrosive Species; (2) Types of Geothermal Corrosion; (3) Geothermal Corrosivity Classification System; (4) Corrosion Engineering for Low-Temperature Direct Utilization Systems. This chapter is based on Radian's geothermal materials database, containing materials performance data from more than 20 low-temperature geothermal sites worldwide. Also included are results of numerous component failure investigations conducted by Radian's Materials Sciences Laboratory (MSL).

30776 (DOE/ID/12693–2, pp. 217-230) **Heat exchangers.** Rafferty, K.D. (Oregon Institute of Technology, Klamath Falls (USA)); Culver, G. Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

Most geothermal fluids, because of their elevated temperature, contain a variety of dissolved chemicals. These chemicals are frequently corrosive toward standard materials of construction. As a result, it is advisable in most cases to isolate the geothermal fluid from the process to which heat is being transferred. The task of heat transfer from the geothermal fluid to a closed process loop is most often handled by a plate heat exchanger. This device provides high thermal performance and ease of maintenance at reasonable cost. For smaller systems, in geothermal resource areas of a specific character, downhole heat exchangers (DHEs) provide a unique means of heat extraction. These devices eliminate the requirement for physical removal of fluid from the well. For this reason, DHE-based systems avoid entirely the environmental and practical problems associated with fluid disposal. Shell and tube heat exchangers play only a minor role in low-temperature, direct-use systems. These units have been in common use in industrial applications for many years and, as a result, are well understood. For these reasons, shell and tube heat exchangers will not be covered in this chapter.

30777 (DOE/ID/12693–2, pp. 231-248) **Space heating equipment.** Rafferty, K.D. (Oregon Institute of Technology, Klamath Falls (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

The performance evaluation of space heating equipment for a geothermal application is generally considered from either of two perspectives; (a) selecting equipment for installation in new construction, or (b) evaluating the performance and retrofit requirements of an existing system. With regard to new construction, the procedure is relatively straightforward. Once the heating requirements are determined, the process need only involve the selection of appropriately sized hot water heating equipment based on the available water temperature. It is important to remember that space heating equipment for geothermal applications is the same equipment used in non-geothermal applications. What makes geothermal applications unique is that the equipment is generally applied at temperatures and flow rates that depart significantly from traditional heating system design. This chapter presents general considerations for the performance of heating equipment at nonstandard temperature and flow conditions, retrofit of existing systems, and aspects of domestic hot water heating.

30778 (DOE/ID/12693–2, pp. 249-260) **Heat pumps.** Rafferty, K.D. (Oregon Institute of Technology, Klamath Falls (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

When geothermal resource temperatures fall below the 100 to 120°F range, it is frequently impractical to use the fluid directly for most applications. Under these conditions, the water source heat pump can provide the necessary temperature boost to concentrate the heat from a very low temperature resource. This is particularly true in areas, such as the northwest, which are characterized by substantial low temperature resources, moderate climate, and low electrical rates. Heat pumps are available in a wide variety of capacities and configurations. Discussing all of these is beyond the scope of this chapter. As a result, the following is limited to commercially available, US manufactured, industrial sized heat pumps.

30779 (DOE/ID/12693–2, pp. 261-270) **Absorption refrigeration.** Rafferty, K.D. (Oregon Institute of Technology, Klamath Falls (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

The absorption cycle is a process by which refrigeration effect is produced through the use of two fluids and some quantity of heat input, rather than electrical input as in the more familiar vapor compression cycle. Both vapor compression and absorption refrigeration cycles accomplish the removal of heat through the evaporation of a refrigerant at a low pressure and the rejection of heat through the condensation of the refrigerant at a higher pressure. The method of creating the pressure difference and circulating the refrigerant is the primary difference between the two cycles. The vapor compression cycle employs a mechanical compressor to create the pressure differences necessary to circulate the refrigerant. In the absorption system, a secondary fluid or absorbent is used to circulate the refrigerant. Because the temperature requirements for the cycle fall into the low- and moderate-temperature range, and there is significant potential for electrical energy savings, absorption would, at first glance, seem to be a good prospect for geothermal application. Absorption machines are commercially available today in two basic configurations. For applications above 32°F (primarily air conditioning), the cycle uses lithium bromide as the absorbent and water as the refrigerant. For applications below 32°F, an ammonia/water cycle is employed with ammonia as the refrigerant and water as the absorbent.

30780 (DOE/ID/12693–2, pp. 271-290) **Greenhouses.** Rafferty, K.D. (Oregon Institute of Technology, Klamath Falls (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

Greenhouse heating is one of the most common uses of geothermal resources. Because of the significant heating requirements of greenhouses and their ability to use very-low-temperature fluids, they are a natural application. The evaluation of a particular greenhouse project involves consideration of the structure heating requirements, the system to meet those requirements, and the annual energy consumption of the project. This chapter is intended to provide information on each of these areas.

30781 (DOE/ID/12693–2, pp. 291-296) **Aquaculture.** Rafferty, K.D. (Oregon Institute of Technology, Klamath Falls (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

One of the most common areas of interest in geothermal direct use is that of aquaculture. For those involved with the initial planning of such a project, one of the first questions to be addressed relates to project size. In most geothermal applications, the maximum pond area that can be developed is restricted by the maximum heat available from the resource. It is the purpose of this chapter to present a brief introduction to the subject of heat loss from ponds (or pools) so that developers can make an informed evaluation of geothermal resources for this purpose.

30782 (DOE/ID/12693–2, pp. 297-318) **Industrial applications.** Lineau, P.J. (Oregon Institute of Technology, Klamath Falls (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook.* Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

Geothermal energy may be used in a number of ways in the industrial field. Potential applications could include drying, process heating, evaporation, distillation, washing, salt, and chemical extraction. The most important energy considerations for an industrial complex are the cost, quality, and reliability. Geothermal energy may be attractive to an industry providing; (a) the cost of energy/lb of product is lower than that presently used, (b) the quality of geothermal energy is as good or better than the present supply, and (c) the reliability of geothermal energy is available for the life of

the plant. Reliability and availability can only be proven by long-term use or testing. While there are many potential industrial uses of geothermal energy, the number of worldwide applications is relatively small. However, a fairly wide range of uses are represented, including vegetable dehydration, grain and lumber drying, pulp and paper processing, diatomaceous earth processing, chemical recovery, and waste water treatment. Industrial applications largely require the use of steam, or superheated water, while agricultural users may use lower temperature geothermal fluids. The largest industrial applications are a pulp, paper, and wood processing plant in New Zealand, a diatomaceous earth plant in Iceland and a vegetable dehydration plant in the US. These systems provide the best present examples of industrial geothermal energy use.

30783 (DOE/ID/12693–2, pp. 319-360) **Engineering cost analysis.** Higbee, C.V. (Oregon Institute of Technology, Klamath Falls (USA)). Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Mar 1989. In *Geothermal direct use engineering and design guidebook*. Order Number DE89010700/JAW. Available from NTIS, PC A 18; 3.

In the early 1970s, life cycle costing (LCC) was adopted by the federal government. LCC was designed to minimize costs of major projects, not only in consideration of acquisition and construction, but especially to emphasize the reduction of operation and maintenance costs during the project life. This chapter on engineering cost analysis is designed to provide a basic understanding and the elementary skills to complete a preliminary LCC analysis of a proposed project. The time value of money is discussed and mathematical formulas for dealing with the cash flows of a project are derived. Methods of cost comparison are presented. Depreciation methods and depletion allowances are included combined with their effect on the after-tax cash flows. The computer program RELCOST, designed to perform LCC for renewable energy projects, is also presented. A discussion of caveats related to performing LCC is included. No one should attempt to do a comprehensive cost analysis of any project without an extensive background on the subject, and considerable expertise in the current tax law.

16 TIDAL AND WAVE POWER

1607 Tidal Power Plants

Refer also to citation(s) 30676

17 WIND ENERGY

30784 (DOE/CH/10093–42) **Wind Energy Program Summary: Volume 2: Research summaries, fiscal year 1988.** Solar Energy Research Inst., Golden, CO (USA). Apr 1989. 68p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000857/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Activities by the Federal Wind Energy program since the early 1980s have focused on developing a technology base necessary for industry to demonstrate the viability of wind energy as an alternative energy supply. The Federal Wind Energy Program's research has targeted the sciences of wind turbine dynamics and the development of advanced components and systems. These efforts have resulted in major advancements toward the development and commercialization of wind technology as an alternative energy source. The installation of more than 16,000 wind turbines in California by the end of 1987 provides evidence that commercial use of wind energy technology can be a viable source of electric power. Research in wind turbine sciences has focused on atmospheric fluid dynamics, aerodynamics, and structural dynamics. As outlines in the projects that are described in this document, advancements in atmospheric fluid dynamics have been made through the development and refinement of wind characterization models and wind/rotor interaction prediction codes. Recent gains in aerodynamics can be attributed to a better understanding of airfoil operations, using innovative research approaches such as flow-visualization techniques. Qualitative information and data from laboratory and field tests are being used to document fatigue damage processes. These data are being used to develop new theories and data bases for structural dynamics, and will help to achieve long-term unit life and lower capital and maintenance costs. Material characterization and modeling techniques have been improved to better analyze effects of stress and fatigue on system components.

30785 (STEV–1989-R1) **IEA R and D Wind Energy. Annual report 1988.** Statens Energiverk, Stockholm (Sweden). 1989. 39p. Order Number DE89766895/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

The IEA R and D WECS programme comprises eleven Tasks, seven of which have been successfully completed. Current Tasks include: Task VIII, Study of Decentralised Applications for Wind energy. Task IX, Intensified Study of Wake Effects behind Single Turbines and in Wind Turbine Parks. Task XI, Base Technology Information Exchange. Task XII, Universal Wind Turbine for Experiments (UNIWEX). Tasks VIII, IX and XI are task-sharing projects, whilst Task XII is mixed task- and cost-sharing. Task VII Study of Offshore WECS was completed during the year and the final report was issued. The main conclusion is that offshore wind energy can be an economic alternative to other forms of electricity generation under favourable conditions in some countries. There are firm plans to construct an offshore demonstration WECS in the UK. Substantial progress is reported from the ongoing Tasks.

1706 Wind Energy Engineering

Refer also to citation(s) 30818

30786 (DTH-AFM–88-12) **Project K 30 meter glass fiber wind turbine-blade. Technological description.** Oeye, S. Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik. Dec 1988. 97p. (In Danish). Order Number DE89776136/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

The construction of a 30m fiberglass blade for a wind-turbine used to produce electric power is explained in detail. The diameter of the wind-turbine's rotor was 60m and the generator power-effect was up to 2 MW. Calculations concerning the blade's volume and rigidity, natural oscillation forms, load and strength distributions and the influence of materials fatigue are presented. (AB) 10 refs.

30787 (EEV–88-02) **Project for the development of competitive wind powered plants.** Danish Wind Technology A/S, Viborg (Denmark). Dec 1988. 50p. (In Danish). Order Number DE89766837/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

EFP-86.

It is proved that it is both technically and economically possible to produce and install medium-sized wind power plants which can compete commercially with smaller ones. This has been proved by carrying out the DWT (Danish Wind Technology) 400 KW windane 34 demonstration project. The project has been set up by Danish Wind Technology A/S supported by the Danish Ministry of Energy under the Ministry's Electric Power Plant's Wind Power Program (EM journal nr. 1354/86-1). (AB).

30788 (NEI-DK–164) **Flap-by-flap testing for materials fatigue in Aerostar 7.5 m wind-turbine blades.** Grove-Nielsen, E. Danish Aeroform APS, Viborg (Denmark). Mar 1989. 32p. (In Danish). Order Number DE89766865/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

A description of the flap-by-flap test procedure for a specific wind turbine blade type, an Aerostar (7.5). Methods for preparatory cleaning and renovation, and for determining stress intensity, and fracture properties and incidence, are described and results are substantially illustrated by photographs, diagrams and charts. (AB).

30789 (PB–89-162069/XAB) **Verification analysis of the toroidal accelerator rotor platform wind energy conversion system. Summary report.** Duffy, R.E. Rensselaer Polytechnic Inst., Troy, NY (USA). Sep 1988. 271p. Available from NTIS, PC A12/MF A01.

Researchers at Rensselaer Polytechnic Institute have studied a unique wind energy system, the Toroidal Accelerator Rotor Platform (TARP). The TARP system places the rotors in pairs on either side

of a torus-shaped platform, so that the wind is forced to flow into the rotors. As the wind is forced around the form, it picks up velocity and turns the rotors faster, generating more power. By concentrating the wind's power, the TARP system can be constructed in modules using 10-foot-diameter rotor blades. Mounted on a track suspension system, the rotors are able to yaw with the wind to take advantage of breezes from any direction. In this project, the basic TARP design was tested and modified in a wind tunnel. The system was then analyzed for its integration into a farm silo and as a multi-stacked wind power needle. It was determined that the TARP technology would be feasible for applications involving sites with high wind velocities, including some sites in New York State.

30790 (SERI/STR–217-3476) **Yaw dynamics of horizontal axis wind turbines: Second annual report.** Hansen, A.; Xudong, C. Utah Univ., Salt Lake City, UT (USA). Dept. of Mechanical Engineering. Mar 1989. 200p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000888/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Numerous problems associated with yaw exist on free-yaw and yaw- driven wind turbines. Yaw-driven machines experience failures in the yaw drive mechanism due to excessive loads, while free-yaw machines experience high yaw rates and yaw misalignment problems. This report describes validation of a model for prediction of wind turbine yaw behavior. The model accounts for the coupled yaw and blade flapping motion of wind machines. The results from the model are compared to results from other analysis methods and to test data. Wind tunnel tests of a rigid-hub, two-bladed rotor, as well as full scale field test data from a rigid-hub, three-bladed turbine are used as the comparison cases in this report. The model predictions show good qualitative agreement with test data, but the magnitudes of predicted yaw moments are in error for some comparison cases. Future work will involve a more in-depth comparison of model results to comprehensive machine test data. Refinements will be made to the analytical model in order to improve correlations between theory and experiment. 7 refs., 19 figs., 2 tabs.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants and Power Generation

Refer also to citation(s) 30749, 30865, 30927, 30928, 30966, 30967, 31041, 31049, 31665

30791 (CONF-890634–1) **Human factors issues related to expert systems for electric power plant control rooms.** Carter, R.J.; Uhrig, R.E. Oak Ridge National Lab., TN (USA). 1989. 16p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From Expert systems applications for the electric power industry conference; Orlando, Florida, USA; 5-8 Jun 1989. Order Number DE89011613/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The primary purpose of expert systems is to represent the knowledge of experts and make the expertise available to the human so that it can contribute to improved performance. In order to achieve this objective, human factors principles must be incorporated into the design. Two surveys oriented towards identifying the human factors issues related to expert systems were conducted. This paper describes the results from those surveys. It discusses the human factors issues under four main categories, the knowledge base of the expert system, the human-expert system interface, organizational support, and related topics (e.g., training, workload, and performance under stress). 21 refs.

30792 (DOE/EIA–0455(87)) **Historical plant cost and annual production expenses for selected electric plants 1987.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 8 May 1989. 294p. Sponsored by DOE Management & Administration. Order Number DE89012561/JAW. Available from NTIS, PC A13/MF A01 - GPO - OSTI; GPO Dep.

Data presented here are intended to provide information to the electric utility industry, educational institutions, Federal, State and local governments, and the general public. These data are collected and published to fulfill data collection and dissemination responsibilities of the Energy Information Administration (EIA), as specified in the Federal Agency Administration Act (Public Law 93-275), as amended. Historical Plant Cost and Annual Production Expense for Selected Electric Plants 1987, initially published in 1982, is a composite of two predecessor publications, Hydroelectric Plant Construction Cost and Annual Production Expenses and Thermal-Electric Plant Construction Cost and Annual Production Expenses. Thermal Electric Plant Construction Cost and Annual Production Expenses (initially published in 1979) contained information on both steam-electric and gas-turbine electric plant construction costs and annual production expenses. The section of tables for historical plant cost, is a summary of the utility's net cumulative-to-date actual outlays of expenditures for land, buildings, and equipment in service. The historical plant cost is the initial investment in the plant plus the costs of all plant additions, less the value of retirements. Thus, historical plant cost often includes expenditures made over several years. Dollars cited represent the amounts recorded in the utility's electric plant accounts. No adjustment has been made to these costs to make them comparable among different facilities or to express them in values representing constant purchasing power. 5 figs., 20 tabs.

30793 (DOE/MC/23167–2678-Vol.2) **Advanced coal-fueled gas turbine systems, Volume 2: Annual technical progress report.** Westinghouse Electric Corp., Orlando, FL (USA). Power Systems Div. Jul 1988. 80p. Sponsored by DOE Fossil Energy. DOE Contract AC21-86MC23167. Order Number DE89000954/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The objective of this contract is to establish the technology required for subsequent commercial development and application by the private sector of utility-size direct coal-fueled gas turbines. Emissions from these units are to meet or be lower than EPA's New Source Performance Standards (NSPS) for coal-fired steam generators. This report is submitted in two volumes. The narrative supporting figures and tables are contained in Volume 1. Thirty-six (36) drawings which were used in the design and manufacture of the subscale slagging combustor, hot gas particulate and alkali probe, and modifications and/or additions to the Haverhill test site are placed in this report. 36 figs.

30794 (EPRI-CS/EL–4415-Vol.6) **Power plant performance monitoring and improvement: Volume 6, Economic dispatch optimization.** Kafka, R. Electric Power Research Inst., Palo Alto, CA (USA); Potomac Electric Power Co., Washington, DC (USA). c May 1989. 435p. Sponsored by Electric Power Research Institute. Order Number DE89012763/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Methods are resented by which the dispatch of an electric system can be improved. These methods require accurate and timely data from generating stations. They also require dispatch methods that operates with the generating units' actual input-output characteristics rather than with input-output curves that are required to be convex and incremental heat rate curves that must be monotonically increasing. 86 figs., 37 tabs., 26 refs.

30795 (NEI-DK–161) **Pumped storage power plants in Denmark.** Cowiconsult Raadgivende Ingenioerer A/S, Virum (Denmark); Danmarks Tekniske Hojskole, Lyngby (Denmark). Lab. for Energiteknik. Dec 1988. 82p. (In Danish). Order Number DE89776140/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

EFP-87.

In 1988 there are about 250 pumped storage power plants throughout the world, yet it is difficult to obtain data about them. They are usually situated in mountainous areas so that great differences in height can be obtained between the upper and lower water storage facilities. These plants consist of the power system (turbines, pumps, generators, motors, etc.) natural or artificial water storage facilities, and water routes, (in and outgoing constructions, pressure pipes, etc.). In Denmark, reversible pumping turbines are preferred, and here specific Danish products are examined (62.5MW and a 125 MW). Possible designs for water storage basins are analyzed in detail, also with regard to their comparative economic advantages. It has been considered reasonable to site

this kind of power plant in Danish coastal regions, this would be the first case where the sea has been used for the lower water storage basin. Possible sites in Jutland and on the island of Als have been investigated. In a basin for a 250 MW pumped storage power plant with optimal production throughout 8 hours, a siting 60 m above sea level could cover power production for an area of about 100 hectars. Material for a dam surrounding the lower water storage system could be produced when digging out the basin. The dam should be about 20m higher than the surrounding terrain and the volume would be about 3,2 mio. m/sup 3/. The filled basin would contain 14.0 mio. m/sup 3/water. The velocity and volume of outgoing water masses would be very considerable and would exact safety precautions to protect ships and bathers. A tentative cost benefit analysis is presented which indicates that the possible establishment of this type of power plant in Denmark could be of considerable interest. (AB). 15 refs.

30796 (OH/RD–004G213) **Electrical parameters of large turbo-generators.** Service, R.R.; Leader, D.C. Ontario Hydro Research Div., Toronto, ON (Canada). 1986. 203p. (CE–02602). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON MEMBERS; MEMBERS PRICES UPON REQUEST, FUNDS CAN.

The electrical parameter data for large generators being supplied by the manufacturers could not adequately model these machines, particularly the turbine-generators. The investigation of frequency response tests as a means of obtaining satisfactory modelling data was needeed. The purpose of this project was to broaden the base of units tested by the Standstill Frequency Response (SSFR) technique by testing and modelling a variety of generator designs, and to investigate the prevalence of units requiring tests with the unit at rated speed to complete the description of the model. The physical characteristics of the rotors of the units tested were to be documented in an effort to relate them to both the model structure and the necessity for on-line testing. Tests were conducted on five large turbo-generators operated by four Canadian utilities. The frequency responses of the SSFR derived data were compared with the responses of the models derived from the data that were currently available for these machines from the utility or the manufacturer of the generator. The testing produced excellent data that were converted into small signal models and corrected to air-gap flux levels which will be usefull for the respective utilities. 13 refs., 22 figs., 1 tab.

30797 (ORNL/CON–278) **Benefits and costs of small, short-lead-time power plants and demand-site programs in an era of load-growth uncertainty.** Hirst, E. Oak Ridge National Lab., TN (USA). Mar 1989. 37p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89012925/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electric utilities face a variety of uncertainties that complicate their long-term resource planning and acquisition. Many utilities deal with these uncertainties by pursuing flexible strategies that emphasize options that allow changes to be made incrementally with little difficulty and at low cost. Thus, utilities today avoid construction of large, baseload power plants because of their long construction times and high capital costs. On the other hand, utilities view combustion turbines as very flexible because they have small unit sizes, take only a few years to build, are inexpensive, and can later be converted to combined-cycle units (to increase capacity and improve performance). Conservation and load-management programs, because of their inherently small unit size and opportunities to adjust participation over time, are attractive for the same reasons. Unfortunately, the emphasis on flexibility may lead to resource portfolios that have higher than necessary lifecycle costs. A major unresolved issue concerns identification of the extra costs associated with small, short-lead-time plants and comparison of these incremental costs with the risk-reduction benefits these small plants provide. The purpose of this report is to compare the benefits of flexibility provided by resources with short lead times and small sizes with the costs of these alternatives. The factors that affect the benefits of constructing such power plants or of running demand-side management programs are identified, the benefits of flexibility in various situations concerning future load growth are computed, and these benefits are compared with the increased costs of such plants. These costs and benefits are explored and quantified with a simple spreadsheet model that analyzes the costs of producing electricity to meet uncertain load growth for a 15-year forecast period. 18 refs., 15 figs., 9 tabs.

30798 (PB–89-165567/XAB) **Technical/economic impacts and implications of using washed coals at New York State utilities. Final report.** Holt, E.C.; Jaffeson, R.C.; Hoffman, L. Hoffman-Holt, Inc., Silver Spring, MD (USA). Sep 1983. 316p. Available from NTIS, PC A14/MF A01.

The Energy Authority has recently completed an analysis of the use of cleaner coal at New York State power plants. The study considered and evaluated various commercially available cleaning methods to reduce the ash and sulfur contents of coal. A cost-benefit analysis was applied to alternative qualities of coal, including those physically cleaned, in order to ascertain their economic viability and fuel suitability for use at New York State utilities. A comprehensive worksheet was designed from the study, which can be applied to a proposed coal and cleaning procedure for use at a particular power plant. The report makes it clear that the primary factors in deciding which method should be used relate to: the cleaning process under consideration, the utility boiler specifications, and the coal specifications (pre and post cleaning). Hence, each power plant site must be considered independently. The report recommended use of cleaner coals because it would cut operating and maintenance costs while reducing negative environmental-emission impacts. In addition, the report recommended a strategically located coal-cleaning facility that could provide cleaner coal to multiple, smaller utility plants or a few larger stations.

30799 (PB–89-166631/XAB) **Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985.** Stukel, J.J. Illinois Univ., Urbana, IL (USA). Coll. of Engineering. Jan 1989. 615p. Available from NTIS, PC A99/MF A01.

See also PB–89-161772. Portions of this document are not fully legible.

This report is one of 11 in a series describing the initial development of the Advanced Utility Simulation Model (AUSM). The AUSM is one of four stationary source emission and control cost-forecasting models developed by EPA for the National Acid Precipitation Assessment Program (NAPAP). The AUSM projects air-pollution emissions (SO_2 and NOx), generating technology types and costs of operation, and combinations of fuels and emission control technologies to simultaneously meet electric demand and emission constraints on a least-cost basis for each year through 2010. Thirteen electric demand regions are simulated, and output is provided for each of the 48 states. The initial version of AUSM, designated Version 1.0, was delivered in November 1984 and August 1985. Further development of the AUSM between 1985 and 1988 has resulted in the development of Versions 2.0 and 3.0. Reports describing these revisions to the initial Version 1.0 of AUSM are also part of this series.

30800 (PB–89-166649/XAB) **Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988.** Capone, R.L.; Lassinger, R.T.; May, E.; Peterson, C.J. Science Applications International Corp., McLean, VA (USA). Jan 1989. 193p. Available from NTIS, PC A09/MF A01.

See also PB–89-166631.

This report gives results of activities relating to the Advanced Utility Simulation Model (AUSM): sensitivity testing, comparison with a mature electric utility model, and calibration to historical emissions. The activities were aimed at demonstrating AUSM's validity over input variable ranges likely to be used for application runs. Univariate sensitivity tests demonstrated that AUSM runs and returns credible results for input ranges expected during model application and addressed issues raised by reviewers. AUSM was compared with Coal and Electric Utilities Model (CEUM) for EPA's 1987 interim base case to compare results and analyze reasons for differences between the output of the two models for 1990 through 2010. Experiments for 1980 through 1985 found ways to calibrate the model

to historical emissions without resorting to scaling or ad hoc methods. All three activities resulted in increased confidence in AUSM for several reasons: AUSM worked well over a wide range of values; sensitivity tests and normal model inputs span such a wide range of possible values that the model will clearly work for any expectable set of inputs; outputs changed in directions and by magnitudes which were consistent with input changes and with analysts' understanding of electric utilities; and all outputs form a consistent set of results.

30801 (STEV-FBT–89-20) **Environmental measurements at the Korsta CFB-boiler.** Herstad, S.; Toernkvist, J. Statens Energiverk, Stockholm (Sweden). Oct 1988. 109p. (In Swedish). Order Number DE89766890/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

Following conclusions can be drawn from the results. * With limestone addition to the boiler the sulfur dioxide emission was very low (<= 1 mgS/MJ/sub eff/), but at the expense of higher nitrogen oxide emission from 120 to 250 mg NO/sub 2//MJ/sub eff/. * The chlorine reduction correlated best to limestone load and flue gas temperature and was at the best 98-99% (<= 20 mg HCL/Nm/sup 3/). * A mercury reduction of about 70% was indicated at low load, low flue gas temperature and high limestone load. * With a limestone flow corresponding to 60 kg limestone/ton RDF the dioxin emission was in the range of 0.5 to 1 ng/Nm/sup 3/. In the other test runs the dioxin emissions varied from 0.2 to 24 ng TCDD-eq/Nm/sup 3/after the flue gas cleaning equipment without any cause identified. After the measurements a leak in the convective part of the boiler was discovered (at the 300 degree C temperature level), which can have influenced the dioxin formation. * Decreased flue gas temperature from 170 to 150 degree C improves the chlorine reduction and makes it perhaps possible to reduce mercury. (authors).

30802 (TTS–711G624) **Steam turbine off-frequency operation.** Burton, W.A.; Sanders, W.P. Turbo-Technics Service, Inc., Toronto, ON (Canada). 1988. 63p. (CE–02603). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Utility steam turbines generating in relatively small interconnected systems are subject to significant frequency variations due to sudden load changes or unit loss. Some blade failures experienced by these utilities may have been caused by stresses created by, or contributed to by, off-frequency operation. Research was performed to study the effect of off-frequency operation on turbine blade life. Five Canadian utilites were surveyed for operational and blade failure information. Several turbine manufacturers were solicited with questions regarding the basis of their turbine off-frequency limits. It was found that only one utility had a blade failure suspected to have been caused by off-frequency operation. It was also determined that several of the utilities surveyed experienced various levels of off-frequency operation approaching the limits of the turbine manufacturers. Finally, it was determined that most of the utilities did not have the means to easily record and determine the accumulated time that their turbines operated off-frequency. Additional work is proposed to develop an off-frequency monitoring system and to conduct further research on the effect of off-frequency operation on blade fatigue life, using computer modeling and blade frequency tests. 24 refs., 20 figs., 12.

2002 Environmental Control Technology

Refer also to citation(s) 30271, 30274, 31041

30803 (DOE/PC/81012–T1-Pt.2) **1.0 Million Btu combustor testing: Test results: Part 2.** Babu, M.; College, J.; Forsythe, R.; Kanary, D. Dravo Lime Co., Pittsburgh, PA (USA). Dec 1988. 45p. Sponsored by DOE Fossil Energy. DOE Contract AC22-85PC81012. Order Number DE89012481/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

"Hydrate Addition at Low Temperature" or HALT is a dry calcium-based hydrate injection process for the removal of SO_2 from flue gases off a sulfur bearing fuel. In this process the hydrate is pneumatically conveyed and injected into the flue gas stream as a dry particulates. The flue gas is cooled downstream of the hydrate injection location by spraying the gas with a stream of finely atomized water droplets. The water is atomized into a fine spray mist by using air under pressure as the atomizing fluid. The waste product from this process is the dry disposable solids which differ considerably from the wet cake solids obtained from a wet FGD process. The HALT test program currently being conducted at Dravo Lime Company and Ohio Edison Company is to be carried out in two stages: (1) Parametric testing on a 1.0 MM BTU/hour combustor, and (2) Follow up long term testing (six months) on a 5 MW unit. The first stage of the program which involves the parametric testing is now completed. Results are presented. 9 refs., 18 figs.

30804 (DOE/PC/91024–T10) **Characterization and fundamental studies on CuO sorbent materials to determine attrition mechanisms on substrate gamma alumina: Technical progress report No. 9, September 23, 1988–December 23, 1988.** Mote, J.D.; Eucker, P.; Zillman, W. Denver Univ., CO (USA). Dept. of Engineering. 1988. 9p. Sponsored by DOE Fossil Energy. DOE Contract AC22-86PC91024. Order Number DE89012588/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The third year of the program is concentrated on ways to improve the strength of the sorbent (alumina) material. In this quarterly report, a brief review of the rationale being utilized to accomplish this is presented along with some preliminary results. Characterization of the modified material will continue in order to determine if any of the successful strengthening methods have altered its sorbent properties. 1 fig., 1 tab.

30805 (DOE/WP/16151–3) **Annual site environmental report for calendar year 1988.** USDOE Western Area Power Administration, Golden, CO (USA). Office of Environmental Affairs. [1989]. 43p. Sponsored by DOE Environment Health & Safety. Order Number DE89012376/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Western Area Power Administration (Western) has established a formal environmental protection, auditing, monitoring, and planning program which has been in effect since 1978. The significant environmental projects and issues Western was involved with in 1988 are discussed in this annual site environmental report. It is written to demonstrate the nature and effectiveness of the environmental protection program. The Department of Energy Order 5400.1, Chapter II.4, requires the preparation of an annual site environmental report. Because Western has numerous facilities located in fifteen states, this report was written to address the environmental activities in all of the facilities as one "site". 5 tabs.

30806 (ISI-A–10-387-0) **Ecological effects of coal use. Final report.** Jochem, E.; Herz, H.; Angerer, G.; Schoen, M. Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung; Deutsche Forschungsgemeinschaft, Bonn (Germany, F.R.). [1987]. 107p. (In German). Order Number DE89774833/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

The analysis of the effects of an increased use of coal on the emission of the pollutants SO/sub 2/and NO/sub x/was dealt with within the framework of the optimization model OPPECK. The model is meant to permit an overall view of cost minimization from the point of view of energy and emissions. The procedure covers the raw material scenario, the technological, ecological and economic description of the various technologies and the demand scenario with end products and secondary energy carriers.

30807 (NEI-DK–155) **Measuring ammonia content in flue gas.** Nielsen, P.R. DK-Teknik, Soeborg (Denmark). May 1988. 18p. (In Danish). Order Number DE89766838/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

As ammonia is utilized in the desulfurization of emission from power plants, there is a standing need for efficient instruments for measuring ammonia content in flue gas. Analysis is hampered by the tendency of ammonia to be adsorbed on solid surfaces when temperatures are under 350 deg. C., and to form ammonium sulfate and ammonium bisulfate when combined with sulfur oxides. A number of measuring principles and systems are described in connection with extraction systems, and the immediate removal of sulfur

oxides from flue gas is recommended. At the present time (May 1988) the only efficient measuring principle seems to be infrared gas filter correlation, IR-GFC, which has been demonstrated in extraction systems, but the principle can also be used in in-situ analysis, and here the serious problem of how to keep the extraction system operating under very high temperatures is thus eliminated. High temperatures could solve the problems of adsorption and bisulfate formation in extraction systems with regard to power plants. (AB).

30808 (PB–89-165088/XAB) **Hydrazine: usage and exposure in the electric power industry.** D.B. Associates, Inc., Salt Lake City, UT (USA). 1989. 21p. Available from NTIS, PC A03/MF A01.

The likelihood of employee exposure to hydrazine, dimethylhydrazines (DMH), and nitrosamines was studied in the coal-fired electric power generation industry. Included in the study were a literature search, contacts with suppliers, contacts with Environmental Protection Agency scientists, and two industrial hygiene surveys at representative power facilities. At each of these facilities hydrazine-hydrate (7803578) was added to the boiler water system to act as an oxygen scavenger. The technician adding the hydrazine at one facility wore a face shield, a rubber apron and rubber gloves. At the second facility the employee wore rubber gloves and goggles. None of the employees at either site had experienced any problems of irritation from hydrazine exposure. Even the distinctive odor of hydrazine was not noticeable. The findings suggest that employee exposures to hydrazine were well below federal standards and that exposures to DMH and nitrosamines appeared unlikely.

30809 (PB–89-165278/XAB) **TEOM(trade mark) real-time carbon-concentration monitor. Final report.** Rupprecht, G.; Patashnick, H. Rupprecht and Patashnick Co., Inc., Voorheesville, NY (USA). Jan 1986. 153p. Available from NTIS, PC A08/MF A01.

This report documents the findings of a project aimed at adapting an existing particulate, mass-measuring device for quick, on-line determinations of the amount of carbon in fly ash. The presence of carbon reduces the efficiency of boilers and decreases the marketability of fly ash. Fly ash is typically used to stabilize certain coal waste products and in building materials. The market value of fly ash as a recyclable waste is inversely proportional to its carbon content. The system was successfully tested on-line at the Rochester Gas and Electric Corporation's Russel Station. Coal-fired utilities could use this instrument, capable of diagnostic and continuous monitoring to help burn coal more efficiently and reduce carbon concentrations in emissions. Included in the report are a description of the Real-Time Mass Measurement – TEOM(TM), oxidation studies, filter and heater-design operation data and laboratory and on-site measurements of operations.

30810 (PB–89-166623/XAB) **N_2O field study. Final report.** Clayton, R.; Sykes, A.; Machilek, R.; Krebs, K.; Ryan, J. Acurex Corp., Research Triangle Park, NC (USA). Southeast Regional Office. Feb 1989. 90p. Available from NTIS, PC A05/MF A01.

This report gives results of measurements of nitrous oxide(N_2O) emissions from coal-fired utility boilers at three electric power generating stations. Continuous emissions monitor measurements were made for nitrogen oxide (NO), O_2, CO_2, and CO. On-line N_2O measurements were made using a gas chromatograph (GC) with electron capture detection. On-line SO_2 levels were measured on one unit using a GC with flame photometric detection. Stainless steel (SS) sample containers were used to collect flue gas samples for the evaluation of N_2O formation as a function of time in the presence of NO, SO_2, and water. The N_2O on-line results were in the range from 'not detectable' to 4.6 ppm. The results did not exhibit apparent differences related to different boiler types and load conditions.

2003 Power Transmission and Distribution

Refer also to citation(s) 30749, 31035, 31132, 32404

30811 (EPRI-ER–6399) **Assessment of higher-temperature superconductors for utility applications: Final report.** Arendt, P.N.; Maley, M.P.; Peterson, D.E. Electric Power Research Inst., Palo Alto, CA (USA); Los Alamos National Lab., NM (USA). c May 1989. 41p. Sponsored by Electric Power Research Institute. DOE Contract W-7405-ENG-36. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report describes the first phase of a program to evaluate the application of high temperature oxide superconductors to ac power transmission – specifically to measure and understand ac losses in the new materials. Information on the known alloy systems was evaluated and Y based materials were selected for development and evaluation. This decision was modified during the course of the research to include Tl based materials. A preliminary evaluation of a variety of fabrication techniques was carried out and sputtering, Taylor wire, and liquid phase epitaxy processes were selected for detailed study. This was later reduced by the elimination of the Taylor wire technique. Development of two sputtering approaches is described. One is based on the use of multiple targets and allows rapid variation of composition; the other is based on a single composite target allowing uniform coverage of larger areas and better reproducibility. The Taylor wire process for producing glass encapsulated HTSC filaments is described and associated problems of contamination discussed. Attempts to expitaxially grow Y, Tl, and Bi based materials on $SrTiO_4$ and other substrates were only partially successful, and samples suitable for critical current measurements were not produced. Transport critical current measurements were performed on both bulk and thin film samples. The behavior of J_c in an applied magnetic field showed unusual hysterisis effects which are explained by flux trapping associated with the weak link structure. An apparatus for measuring hystertic ac losses similar to one developed in an earlier EPRI program is described and losses were measured on a sintered sample of $YBa_2Cu_3O_7$. 10 refs. , 8 figs., 5 tabs.

30812 (IREQ–146T328) **Study of effective aeolian wind power imparted to single conductor spans.** Noiseux, D.U.; Houle, S.; Beauchemin, R. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). 1986. 284p. (CE–02600). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The purpose of this project was to determine the effective aeolian power imparted to single conductors by natural wind. Four different conductors were used. The antinode displacements of the conductors, the wind velocity and turbulence were measured at the experimental line and the internal power dissipated by the conductors measured in the laboratory. Combining this information yielded the effective aeolian power as a function of the antinode displacements, with the wind turbulence as a parameter. Two methods of data analysis were used. The results from field and laboratory tests were combined and normalized. The aeolian power is obtained by combining these two results. These results were then compared with those available from wind tunnel tests. Wind turbulence reduces the effectiveness of aeolian excitation, as seen from the results presented by both methods. 16 refs., 50 figs., 11 tabs.

30813 (IVO-A–03/88) **Fault Location in the Finnish transmission network.** Kosola, J.; Kuussaari, M.; Paeivinen, R.; Rantanen, K.; Vaelimaa, S. Imatran Voima Oy, Helsinki (Finland). Dec 1988. 81p. (In Finnish). Order Number DE89766977/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Technical methods suitable for fault location in the Finnish transmission network have been examined. The principles, main features of technical solution as well as the limitations of different methods are dealt with. The accuracy of methods have been examined theoretically based on the nature of faults in the overhead transmission line and in practice by means of laboratory and field tests. The methods discussed are based on the measurement of the electrical characteristics of overhead lines (current, voltage or high-frequency signals). Some of the methods make use of permanently assembled equipment and some of movable one. The benefits achieved in fault location have been examined on the basis of the outage costs of permanent line faults. Decrease in the duration of interruptions has been approximated by the aid of fault statistics. Savings in the annual outage costs have been calculated according to a probability of permanent line faults. These savings have been compared to the annual costs of each method. The results of cost comparison show

that it is not economically justified to build a vast fault location system based on permanently assembled equipment. This is due to the low frequency of permanent line faults in the transmission network. If, however, permanent equipment would be considered for some lines, a cost comparison should be made along the pattern laid down in this report.

30814 (OH/RD–072T223) **Development of improved sheath cross-bonding joint protectors for self-containing underground cables.** Erven, C.C.; Ringler, K.G. Ontario Hydro Research Div., Toronto, ON (Canada). 1986. 126p. (CE–02597). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objective of this project is to develop an improved surge protector to limit the transient voltages on cable sheath circuits, using the superior non-linear resistance characteristics of metal-oxide ceramics. To assess the transient voltages and the requirements of a metal-oxide protective device, a detailed analysis was carried out using digital simulation techniques. Field measurements, before and after the installation of surge protectors, were then carried out to verify the analytical results. The results show that metal-oxide varistor elements, similar to those used in surge arresters, can be used to develop a simple and economic surge protector for application on new or existing high voltage underground cable systems. A better form of surge protection is necessary, not only to restore confidence in the use of self-contained cable systems with cross-bonding, but to provide better protection and thus extend the useful life of those already in service. 27 refs., 56 figs., 7 tabs.

30815 (OH/RD–177T510) **Aeolian vibration excitation of bundle conductors. Vol. 1 and 2.** Pon, C.J.; Havard, D.G.; Currie, I.G.; MacDonald, R. Ontario Hydro Research Div., Toronto, ON (Canada). 1989. 258p. (CE–02618). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.0-0 NON-MEMBERS; MEMBERS PRICES UPON REQUEST, FUNDS CAN.

The objective of this project is to measure, under laboratory conditions, the aeolian wind power imparted to bundle conductors on overhead electric power lines. To help accomplish this objective, a literature survey was conducted to draw on the experiences of other researchers to optimize the design and procedure of the tests. An adjustable two conductor bundle model was constructed and tests were performed in the University of Toronto micrometeorological wind tunnel. The results show that, in general, the wind power input to the downstream conductor of a bundle is greater than the wind power input to a single conductor. The input wind power to the downstream conductor decreases as the bundle separation is increased. The scatter of input wind power for various velocities decreases as the bundle separation increases. The range of velocities in which the vortex shedding frequency locks in to the natural frequency of the model narrows as the bundle separation is increased. The downstream conductor exhibited random motions when constrained to move at angles less that 67.5 degrees to the wind. The downstream conductor behaved like a single conductor when the bundle was oriented at angles greater than 20 degrees to the wind. 135 refs., 163 figs., 15 tabs.

30816 (ORF/T–228U359) **Development of design guidelines and practices for improving residential service entrances.** Keyes, C. Ontario Research Foundation, Toronto, ON (Canada). 1987. 156p. (CE–02608). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

While residential service entrances are generally considered as relatively safe, they have been historically a major source of electrical fires. Some remedial measures have been implemented by regulatory and certification authorities, but there is some doubt that these will be completely satisfactory when loads such as electric heating are introduced. The primary objectives of this report were to investigate the problems associated with new and existing service equipment and to develop and recommend guidelines and practices for improving residential service entrances. Existing and new service equipment are reviewed and guidelines and recommendations are presented; the recommendations include: treatment of existing services when electric heat is added, tests for screening and certifying components, guidelines for designing new equipment and guidelines for installing new equipment. 38 refs., 28 figs., 27 tabs.

30817 (SC–653U604) **Electicity supply voltage problems.** Richards, B. Shawinigan Consultants, Inc., Montreal, PQ (Canada). 1988. 65p. (CE–02604). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The purpose of this research paper is to produce a series of bulletins for improving the awareness of all classes of power users about the types of electricity supply voltage problems which can occur and their effects and what can be done to eleminate or alleviate these effects. A survey was also made of the standards or guidelines used by utilities to limit the effects of voltage flicker and harmonic distribution. 22 refs., 8 figs., 8 tabs.

30818 Evaluation of stand-alone inverters for remote applications. Bower, W. (Sandia National Labs., Photovoltaic Systems Research Div., Albuquerque, NM (US)). v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

A stand-alone or autonomous system that supplies ac electric power to loads in remote applications is a mini-utility. It requires all the basic elements of a large system. The basic elements are the energy source, a storage medium, and a power conditioner (inverter) with control and distribution capabilities. The source will probably be one of the renewable sources of energy such as wind or photovoltaics. The electrical storage will be a battery bank. The inverter, with this variable energy source and energy storage sized for the autonomy of the system, must be capable of converting the energy, and supplying controlled ac power to the loads, on demand, and in a safe, efficient, reliable, and compatible manner.

30819 Analysis of water heater data from Athens load control experiment. Reed, J.H. (Oak Ridge National Lab., Oak Ridge, TN (US)); Thompson, J.C.; Broadwater, R.P.; Chandrasekaran, A. *IEEE Transactions on Power Delivery (USA),* 4(2): 1232-1238 (Apr 1989).

This paper describes water heater load control experiments on the Athens Utilities Board distribution system in Athens, Tennessee. Data from experimental days are compared to data from days of normal operation to assess the effects of the control experiments. Plots are presented to describe water heater operation. Water heater models are used to estimate water usage. Results indicate that water heater control reduces energy demand but may have adverse effects on daily load patterns. Analysis also shows that the operation of load control receivers deteriorates as the time duration of the control period is increased. Methods used to improve data integrity are presented. The results are based on the filtered data set. The problems of identifying the associated time skew in the data and the timing-out of load control receivers are addressed. These results should be of interest to utilities performing similar load control management.

21 NUCLEAR POWER PLANTS

Refer also to citation(s) 30876

30820 (NUREG–0020-Vol.13-No.4) **Licensed operating reactors: Status summary report data as of March 31, 1989.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Information Resources Management. May 1989. 503p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A22/MF A01 - GPO - OSTI.

The US Nuclear Regulatory Commission's monthly LICENSED OPERATING REACTORS Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata

from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information, such as spent fuel storage capability, reactor years of experience, and non-power reactors in the United States.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

Refer also to citation(s) 30895, 30920, 31003, 32072, 32074

30821 (EPRI-NP–6363) **Proceedings: 1986 workshop on advanced high-strength materials.** Gennaro, M.S.; Nelson, J.L. Electric Power Research Inst., Palo Alto, CA (USA); Stone and Webster Engineering Corp., Boston, MA (USA). c May 1989. 578p. Sponsored by Electric Power Research Institute. (CONF-8603261–; Workshop on advanced high-strength materials, Clearwater Beach, Florida, USA, 12-13 Mar 1986). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

High strength alloys X-750, 718, and A-286 are used for a number of internal structural components in light water reactors (LWR). Typical applications are bolts, springs, pins, and similar parts. Incidences of component failures due to stress corrosion cracking (SCC) prompted a considerable amount of research in this field. A workshop titled, "Advanced High Strength Materials", was held in Clearwater Beach, Florida on March 12 and 13, 1986, hosted by the Electric Power Research Institute. The purpose of the workshop was to collect and review experience with failures of these materials in the LWR environments, with an emphasis on the characteristics and behavior of alloy X-750, which is most often used for these applications. Twenty-five papers were presented covering field experience and results obtained in laboratory tests and research programs. Presentations discussed the effects of metallurgical factors, manufacturing processes, design improvements, and installation practices on the resistance to SCC. The workshop proceedings provide a basis for remedial measures necessary to reduce SCC of internal structural components in LWR. Individual projects are processed separately for the data bases.

30822 (EPRI-NP–6375) **Evaluation of potential benefits of transportable storage casks: Final report.** Casper, R.M.; Collier, D.M.; Lee, W.J.; Houston, J.V. Electric Power Research Inst., Palo Alto, CA (USA); Nuclear Assurance Corp., Norcross, GA (USA). c May 1989. 124p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A cash-flow methodology was developed to compare various waste-management system scenarios and evaluate the use of transportable storage casks (TSC). The net present value is used as the basis for scenario comparison. Five scenarios were analyzed considering: at-reactor spent-fuel storage in metal casks, transport of spent fuel by rail from reactors to the DOE facilities, lag storage and the interim storage of consolidated spent fuel at the monitored retrievable storage (MRS) facility, and transport of consolidated spent fuel from the MRS to the repository. The TSC Utilization Case is the lowest cost case; it is $39 million to $175 million less costly than the Base Case, which uses storage-only casks in conjunction with transport-only casks. The results indicate that potential cost savings and reduced casks/spent-fuel handling can be obtained with integrated use of TSCs in the waste-management system.

30823 (LUTFD2-TFRT–5371-1-76-1987) **Analysis of resonance oscillation of the neutron flow in a BWR-core.** Storm, J. Lund Univ. (Sweden). Dept. of Automatic Control. Sep 1987. 77p. (In Swedish). Order Number DE89614336/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Examination paper.

This is a thesis which has been made within the institution of automatic control in Lund. Two programs, 'Blackie' and 'Test' have been written in Fortran. These two programs are to be used for the evaluation of ASEA-ATOMs resonance test in different nuclear reactors. In these tests the condition of the reactor becomes more and more unstable because the coolant flow decreases at the same time as the power gradually increases. This leads to resonance in the neutron flow. This flow is measured by detectors placed in different parts of the reactor core. 'Blackie' receives and stores the values sampled by the detectors. The same program also carries out a Fourier analysis. Amplitudes and phase angles from the different oscillations are calculated. These results are then used as inputs for 'Test'. 'Test' is a plotting program. It draws the reactor and plots arrows where the detectors are situated. The size and direction of the arrows are measurements of the amplitudes and phase angles of the neutron flow oscillations. From these arrow diagrams you can come to conclusions about the oscillations in the neutron flow and how the affect the reactor.

30824 (NUREG/CR–5244) **Evaluation of non-radiological water chemistry at power reactors.** Banerjee, S.; Castrogivanni, M.A.; Cruz, C. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and Systems Technology; Brookhaven National Lab., Upton, NY (USA). May 1989. 62p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–52166). Available from NTIS, PC A04/MF A01 - GPO - OSTI.

The NRC's inspection program for the evaluation of non-radiological water chemistry practices at nuclear power plants includes performance testing by licensees. Plant laboratories analyze certified standards prepared by Brookhaven National Laboratory (BNL) during an on-site evaluation by an NRC inspector. Additionally, coolant or other water samples are split for comparative licensee/BNL analysis. This report summarizes and statistically evaluates licensee performance data for 43 plants in Regions I–IV. The results are compared with those from an earlier cycle in which only Region I participated. Substantial improvement in Region I's performance was observed. Of the analytes considered, the greatest analytical uncertainty was consistently associated with chloride, probably as a result of matrix effects. 3 refs., 7 tabs.

30825 (ORNL/tr–89/10) **Hydraulic control rod drive for water-cooled nuclear reactors, particularly heating reactors.** Batheja, P.; Oehrlein, M.; Rau, P.; Weber, E. Oak Ridge National Lab., TN (USA). 1989. 43p. Translation of European Patent Application 0,252,326, January 13, 1988. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89012499/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This invention consists of a hydraulic control rod drive for water-cooled nuclear reactors, particularly heating reactors, having a reactor pressure vessel and having a reactor core supported in it, consisting of a fuel assembly field in an upright configuration and control rods supported so that they can be inserted into or withdrawn from interspaces between the fuel assemblies, in or counter to the direction of gravity, whereby drive rods of the control rods are provided with hydraulic piston-cylinder systems, to which the cooling water can be supplied from below as the working fluid through reactor-internal fluid lines, whereby the cooling water reservoir is used as a hydraulic drain. 13 figs.

30826 (STUDSVIK-STSRX–1) **Fabrication and characterization of ASEA-ATOM fuel rods for the Super-Ramp Extension Project: The Super-Ramp Extension Project.** Micko, A. Studsvik Energiteknik AB, Nykoeping (Sweden). [1989]. 36p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012708/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report documents the fabrication and characterization for 10 ASEA-ATOM designed fuel rods supplied to the Studsvik SUPER-RAMP EXTENSION Project. The fuel rods being supplied to the SRX Project were initially designed and characterized for an ASEA-ATOM ramp program. The rods have been pre-irradiated for 23040 EFPH in the nuclear power plant Oskarshamn 2 for 3 cycles from 1980 to 1983. The reactor is owned and operated by OKG AKTIEBOLAG. Each of the segmented fuel rods in the 8 x 8 assembly was made up with seven removable segments. The clad material is fabricated by Sandvik AB in Sweden. The UO_2 pellet fuel and fuel rods were fabricated at the ASEA-ATOM fuel factory in Vaesteras. Design parameters of the rods supplied are listed. The ASEA-ATOM Quality Assurance Program ensures that products are designed, manufactured, inspected and delivered in accordance with the requirements of USNRC 10 CFR50 Appendix B. 12 figs., 21 tabs.

30827 (STUDSVIK-STSRX–2) **Base irradiation history report of ASEA-ATOM fuel rods for the Super-Ramp Extension Project.** Micko, A. Studsvik Energiteknik AB, Nykoeping (Sweden). Sep 1984. 20p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012709/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

This report presents the detailed pre-irradiation history of the test rods in Oskarshamn 2. ASEA-ATOM has been supplying a total of 10 BWR test fuel rod segments irradiated in two fuel assemblies to the Studsvik SUPER-RAMP EXTENSION Project. The rods have been pre- irradiated for 23040 EFPH in the Oskarshamn 2 nuclear power plant for 3 cycles from 1980 to 1983. The reactor is owned and operated by the OKG AKTIEBOLAG. Each of the segmented fuel rods in the 8 x 8 assembly was made up of seven removable segments. The fuel cladding was fabricated by Sandvik AB in Sweden. The UO_2 fuel pellets and the fuel rods were fabricated at the ASEA-ATOM fuel factory in Vaesteras. 9 figs., 6 tabs.

30828 (STUDSVIK-STSRX–3) **Hot cell interim examination of OII stringer rod OA1: The Super-Ramp Extension Project.** Birath, S.; Bivered, B. Studsvik Energiteknik AB, Nykoeping (Sweden). Mar 1984. 12p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012710/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

This report covers the following interim examinations performed in hot cells of the stringer rod OA1 irradiated in the Oskarsham II power reactor: External visual inspection of segment OA1-3 and gamma scanning on all five segments. 12 figs., 1 tab.

30829 (STUDSVIK-STSRX–4) **The Studsvik Super-Ramp Extension Project: Complementary post-irradiation examinations of KWU/CE rods at Karlstein.** Dewes, P. Studsvik Energiteknik AB, Nykoeping (Sweden); Kraftwerk Union A.G., Erlangen (Germany, F.R.). Geschaeftsbereich Kernbrennstoffkreislauf. Aug 1984. 66p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012711/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.

As a part of the Studsvik SUPER-RAMP Extension Project (SRX) additional post-irradiation examinations were performed on test fuel rods supplied by KWU/CE for the SUPER-RAMP Project (SR). The objective was to extend and complete the data base, particularly with respect to the different PCI-failure propensity of the various rod groups. Therefore, the series of fuel and clad inside studies, performed in the SR Project at local ramp power of 420 to 440 W/cm was expanded to investigate the effects of reduced clad temperature and of short hold time at ramp power. On the other hand, the condition of the fuel rods prior to the ramp test was studied by examination of one base-irradiated, non-ramped rod of each group. This report describes the results of these examinations. The detailed scope of the examination program together with the main irradiation data of the test fuel rods is shown in this document. 1 ref., 27 figs., 4 tabs.

30830 (STUDSVIK-STSRX–7) **Power ramp irradiation of AA test fuel rods OA1-1,-2,-3,-4 and OL1-1, -4: The Super-Ramp Extension Project.** Roennberg, G. Studsvik Energiteknik AB, Nykoeping (Sweden). Oct 1984. 24p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012714/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Six BWR test fuel rods, supplied by ASEA-ATOM, have been power ramp tested. The objective of the tests was to determine safe ramp rates. 2 refs., 14 figs., 2 tabs.

30831 (STUDSVIK-STSRX–11) **The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1984–February 28, 1985.** Djurle, S. Studsvik Energiteknik AB, Nykoeping (Sweden). Mar 1985. 15p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012718/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

This is the second Progress Report distributed from the STUDSVIK SUPER-RAMP EXTENSION Project. It covers the period October 1984 through February 1985. The program incorporates the following two subprograms: a PWR subprogram with complementary post irradiation examinations of SUPER-RAMP PWR test fuel rods, and with power rampings of KWU test fuel rods (PK1X), and a BWR subprogram with complementary post irradiation examinations of SUPER-RAMP BWR test fuel rods, and with slow power rampings of AA test fuel rods.

30832 (STUDSVIK-STSRX–12) **The Studsvik Super-Ramp Extension Project: Ceramography of Asea Atom test fuel rod OL1-1.** Schrire, D.; Mattsson, O.; Claesson, B. Studsvik Energiteknik AB, Nykoeping (Sweden). Apr 1985. 13p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012719/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report presents the results of a ceramographic examination, including autoradiography, of an axial section from the maximum ramp power position of rod OL1-1. Rod OL1-1 was ramped to 48 kW/m without failing. A 27 mm long axial ceramographic sample was cut out at a position between 264 mm and 291 mm from the bottom end of the bottom plug, corresponding to the location with the highest linear heat rating during the ramp. 7 figs., 2 tabs.

30833 (STUDSVIK-STSRX–13) **The Studsvik Super-Ramp Extension Project: Progress report, March 1, 1985–September 30, 1985.** Djurle, S. Studsvik Energiteknik AB, Nykoeping (Sweden). Oct 1985. 17p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012720/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

This is the third progress report distributed from the Studsvik Super-Ramp Extension Project. It covers the period March through September 1985. The scope of the Technical Program for the Project is an extension of the work already performed in the Super-Ramp Project and is an experimental investigation of the pellet-clad interaction (PCI) performance under power ramp conditions for commercial type LWR test fuel rods irradiated to high burnup. The program incorporates the following two subprograms: a PWR subprogram with complementary post irradiation examinations of Super-Ramp PWR test fuel rods, and with power rampings of KWU test fuel rods (PK1X). A BWR subprogram with complementary post irradiation examinations of Super-Ramp BWR test fuel rods, and with slow power rampings of AA test fuel rods. 18 refs., 2 tabs.

30834 (STUDSVIK-STSRX–15) **The Studsvik Super-Ramp Extension Project: Non destructive examinations of the PK1X rod and the rod OL1-5.** Bergenlid, U.; Gustafsson, I. Studsvik Energiteknik AB, Nykoeping (Sweden). Oct 1985. 12p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012722/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The four ramp tested PK1X rods have been examined by means of profilometry and eddy current tests before and after the power rampings. Post-ramp neutron radiographs were taken of three of the rods. The fifth PK1X rod was also examined but not ramp tested. Finally, radiographs were taken of the spare BWR segment OL1-5. 9 figs., 1 tab.

30835 (STUDSVIK-STSRX–16) **The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1985–March 31, 1986.** Djurle, S. Studsvik Energiteknik AB, Nykoeping (Sweden). Apr 1986. 16p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012723/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the fourth Progress Report distributed from the STUDSVIK SUPER-RAMP EXTENSION Project. It covers the period October 1985 through March 1986. The program incorporates the following two subprograms: a PWR subprogram with complementary post irradiation examinations of SUPER-RAMP PWR test fuel rods, and with power rampings of KWU test fuel rods (PK1X), and a BWR subprogram with complementary post irradiation examinations of SUPER-RAMP BWR test fuel rods, and with slow power rampings of AA test fuel rods.

30836 (STUDSVIK-STSRX–17) **The Studsvik Super-Ramp Extension Project: Destructive post-irradiation examinations of rod group PK 1X.** Dewes, P. Studsvik Energiteknik AB, Nykoeping (Sweden); Kraftwerk Union A.G., Erlangen (Germany, F.R.). Aug 1986. 23p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012724/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As part of the SUPER-RAMP Extension Project (SRX) the PK 1 test series was continued by three ramp tests on similar fuel rods of the group PK 1X. The main irradiation data and the scope of destructive examination performed after irradiation are shown in Table 1. In the PK 1X tests the influence of a reduced rod cladding temperature was studied. At nearly identical power steps of 210 and 200 W/cm, respectively, the rod operating at the low temperature (PK 1X/s) failed, whereas the rod PK 1X/2 with high cladding temperature survived. At a smaller power increase of 185 W/cm the fuel rod PK 1X/3 also survived despite the low cladding temperature. 9 figs., 3 tabs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

Refer also to citation(s) 30821, 30822, 30824, 30825, 30831, 30832, 30833, 30834, 30835, 30836, 30874, 30877, 30883, 30884, 30895, 30898, 30902, 30905, 30908, 30920, 31003, 31591

30837 (CTA-IEAv-NT–009/88) **Transient performance of flow in circuits of PWR type reactors.** Hirdes, V.R.; Carajilescov, P. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Sep 1988. 6p. (In Portuguese). Order Number DE89614410/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Generally, PWR's are designed with several primary loops, each one provided with a pump to circulate the coolant through the core. If one or more of these pumps fail, there would be a decrease in reactor flow rate which could cause coolant phase change in the core and components overheating. The present work establishes a simulation model for pump failure in PWR's and the SARDAN-FLOW computes code was developed, considering any combination of such failures. Based on the data of Angra I, several accident and operational transient conditions were simulated.

30838 (EPRI-NP–5561-CCM-Vol.1-Rev.1) **MULTEQ: Equilibrium of an electrolytic solution with vapor-liquid partitioning and precipitation: Volume 1: User's manual, Revision 1.** Alexander, J.H.; Luu, L. Electric Power Research Inst., Palo Alto, CA (USA); S-Cubed, San Diego, CA (USA). c May 1989. 125p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A major problem in the operation of PWR steam generators is corrosion in heated crevices. Estimating the pH of the boiler water as it becomes more and more concentrated in the crevice environments is an important tool to use in preventing corrosion. Measuring the pH of a sample in this harsh environment is difficult under the best of circumstances and, at present, not possible in steam generators. The MULTEQ computer code provides a method for calculating estimates of the changing pH of an electrolytic solution as it is subjected to the process of concentration that takes place in crevices. The MULTEQ computer code runs on an IBM PC. It was designed with the idea of making it as easy to use as possible. The user is prompted to key in the concentrations of the primary constituents that occur in the boiler water whose pH he wishes to estimate and the temperature at which the concentration process is to take place. The code then scans its thermochemical data base from which it extracts all the data that it has pertaining to species that would occur in a solution containing the input consituents. The user has a choice of three models for the concentration process, and is provided with tools for displaying the results of the calculation either in tabular or in graphical form.

30839 (EPRI-NP–6341) **PWR steam generator tube fretting and fatigue wear: Final report.** Hofmann, P.J.; Schettler, T. Electric Power Research Inst., Palo Alto, CA (USA); Siemens A.G., Erlangen (Germany, F.R.). c Apr 1989. 637p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Experimental work determining the wear rates at an elevated water temperature of 200°C (392°F) for typical pressurized water reactor (PWR) steam generator tubing has been performed. These wear rates have been generated for specific tube/tube support plate interaction characteristics comprised of tube contact force, relative sliding distance and the average time of a single contact event. This information when coupled with predictions of tube/tube support plate interaction characteristics associated with multispan steam generator tube geometries can be used to determine lifetime fretting and fatigue wear rates. This report details the test hardware and techniques employed to obtain the data, and provides insight into tube wear empirical modeling. 51 refs., 154 figs., 14 tabs.

30840 (EPRI-NP–6362-M) **Examination of pits in Trojan nuclear power plant steam generator tubes: Final report.** Powell, D.E. Electric Power Research Inst., Palo Alto, CA (USA); Combustion Engineering, Inc., Windsor, CT (USA). Nuclear Power Businesses. c May 1989. 13p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report presents the results from examination of defects, oxides, and corrosion products on three steam generator tubes removed from the Trojan Nuclear Plant of Portland General Electric. In-generator eddy current inspection of the steam generator tubes suggested the probability of pits in one tube, located several inches above the tubesheet, within the height of the sludge pile. A weak indication was reported in the second tube, also within the height of the sludge pile. Copper signals were reported above the tubesheet and first support plate for the third tube which was removed. Destructive examination revealed numerous pits in a band several inches above the tubesheet. The depth of the pits corresponded to those anticipated by field eddy current testing. The pits contained a chromium rich iron and nickel depleted corrosion product with traces of copper and zinc. Intergranular penetrations were present at the base of the pits. Traces of sulfur and chlorine were found within the penetrations. Additionally, nickel sulfide and copper sulfide ribbons were present within the corrosion products of the pits. Sulfate and chloride anions were also observed in concentrations of hundreds of parts per million (each) within the exterior surface oxides. Hence, the pitting corrosion was attributed to acid forms of sulfur, acting synergistically with chlorides. The oxides on the external surfaces of the steam generator tubes were found to consist of magnetite (Fe_3O_4) with minor components of franklinite ($ZnFe_2O_4$). Embedded within this composite were numerous particles of copper in the elemental form. 8 refs.

30841 (INIS-mf–11935) **Behavior of a corium jet in high pressure melt ejection from a reactor pressure vessel.** Frid, W. Royal Inst. of Tech., Stockholm (Sweden); Swedish State Power Board, Vaellingby (Sweden). 1987. 227p. Order Number DE89775050/JAW. Available from NTIS (US Sales Only), PC A11/MF A01.

This report provides results from analytical and experimental investigations on the behavior of a gas supersaturated molten jet expelled from a pressurized vessel. Aero-hydrodynamic stability of liquid jets in gas, stream degassing of molten metals and gas bubble nucleation in molten metals are relevant problems which are addressed in this work. Models are developed for jet expansion, primary breakup of the jet and secondary fragmentation of melt droplets resulting from violent effervescence of dissolved gas. The jet expansion model is based on a general relation for bubble growth which includes both inertia-controlled and diffusion-controlled growth phases. The jet expansion model is able to predict the jet void fraction, jet radius as a function of axial distance from the pressure vessel, bubble size and bubble pressure. The number density of gas bubbles in the melt, which is a basic parameter in the model, was determined experimentally and is about 10/sup 8/per m/sup 3/ of liquid. The primary breakup of the jet produces a spray of droplets, about 2-3 mm in diameter. Parametric calculations for a TMLB' reactor accident sequence show that the corium jet is disrupted within a few initial jet diameters from the reactor vessel and that the radius of corium spray at the level of the reactor cavity floor is in the range of 0.8 to 2.6 m.

30842 (ITEF–16(1988)) **Computer experiment for 3.65 GeV proton beam with a lead target for comparison of the MARS4 and HETC computer codes.** Kazaritskij, V.D.; Kobzarev, K.K. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki. 1988. 19p. (In Russian). Order Number DE89617197/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Within the framework of the problem of radiation fields generated during lead target inteaction with a 3.65 GeV proton beam two programs simulating MARS4 and HETC high-energy particles are compared. The results obtained agree well. Some discrepancies in the spectra of particle outlet from the target close to 50 MeV and at high energies for particles flying back towards the beam are noted. The dependence of results of calculations of distributions of integral particle fluxes on the type of estimates of the Monte Carlo method and sampling volume is considered. 7 refs.; 15 figs.

30843 (STUDSVIK-STSRX–10-Rev.) **Fabrication, pre-irradiation characterization and base-irradiation data of test fuel rod group PK1X: The Super-Ramp Extenstion Project.** Dewes, P.; Lorz, E. Studsvik Energiteknik AB, Nykoeping (Sweden). Apr 1986. 27p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012717/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

For the extension of the SUPER-RAMP Project KWU will supply three PWR test fuel rods and two additional spare rods of the same rod type denoted PK1X, which correspond to the fuel rod type PK1 used in the SUPER-RAMP Project. The PK1X rods were fabricated and characterized during fabrication in the year 1977, in parallel with the PK1 rods. The base-irradiation of both rod groups in the nuclear power plant Obrigheim (KWO) started in June, 1977. In Part A this report presents the data on fabrication and pre-irradiation characterization and in Part B the data on base-irradiation history of the PK1X rods. Since the design of these rods, the fabrication process and the most part of the materials used for rod components as well as the irradiation conditions in KWO are identical to that of the rod group PK1, only the data being particular for the PK1X rods are outlined here. 2 refs., 5 figs., 6 tabs.

30844 (STUDSVIK-STSRX–14) **The Studsvik Super-Ramp Extension Project: Power ramp irradiation of test fuel rod group PK1X.** Djurle, S. Studsvik Energiteknik AB, Nykoeping (Sweden). Sep 1985. 18p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012721/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

Four PWR test fuel rods, supplied by KWU, have been power ramp tested. The objective of the tests was to investigate the influence of clad temperature on the rod ramp behaviour. The test irradiations were performed with the use of the same equipment and following the same procedures as for the previous ramp tests in the Super-Ramp program. 2 refs., 11 figs., 2 tabs.

2103 Power Reactors, Non-breeding, Graphite Moderated

Refer also to citation(s) 30906, 30910, 30917, 31323, 31983, 32007, 32013, 32016, 32017, 32377, 32389

30845 (Juel–2240) **Determination of effective cross sections and burnup calculation for HTR-irradiations in a reflector position of the research reactor FRJ-2 (DIDO).** Weise, L.; Borchardt, G.; Meixner, C. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Brennelement- und Bestrahlungstechnologie. Nov 1988. 109p. (In German). Order Number DE89774817/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Since years irradiations of HTR-spherical fuel elements have been done, in the course of which the target burnup of the nuclear fuel has a fixed value. For the prediction of the shutdown moment it is necessary to know the momentary fuel burnup state of the irradiation experiment at any time. On account of the construction of the irradiation rig the fuel burn up determination can only be performed by calculation. Only after the irradiation end, the reached fuel burnup can likewise be measured by γ-spectrometry or by mass spectrometry. The report describes the neutronic calculations which are needed for the fuel burnup determination. Under the given circumstances especially the selfshielding correction for the spherical fuel element is accentuated which in the case of low enriched fuel is inevitable because of the resonance absorption of the neutrons in the nuclear fuel U238. It appears, that under optimal circumstances our burnup calculation is feasible with an average relative single standard deviation of approximately 7%. In the case of the irradiation experiment JK13 there was found an agreement between the total burnup which was calculated by our treatment on one hand, and those which was measured in the hot cells of the KFA on the other. This statement refers to a statistical significance level of 95%.

30846 (OEVS-Mitteilung–1988, pp. 776-780) **Estimation of the nuclide inventory of the Chernobyl core at the time of accident.** Kirchner, G. (Bremen Univ. (Germany, F.R.)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Activity ratios of different isotopes of the same chemical element measured in the Chernobyl fallout give information on burnup and time of shutdown before the accident occured. From a series of measurements the mean Cs 134/Cs 137 and Cs 136/Cs 137 activity ratios are derived and compared to corresponding time-dependent activity ratios specific for the Chernobyl reactor. The resulting burnup characteristics enable a calculation of the nuclide inventory at the time of accident. Results are presented for selected radionuclides. The C 14 inventory of the graphite moderator is obtained from a separate calculation. 5 refs., 1 fig., 2 tabs.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 30871, 30872, 30897, 31653

2105 Power Reactors, Breeding

Refer also to citation(s) 30445, 30926, 31189

30847 (CEA-CONF–9719) **Manufacture of the first fuel charge for the SUPER-PHENIX 1 reactor.** Pajot, J.; Beche, M.; Heyraud, J. CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). 1988. 23p. (CONF-881286–: Symposium on Nuclear Fuel Fabrication (NUFFAB '88), Bombay, Indiana, USA, 12-14 Dec 1988). Order Number DE89770506/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

After summarizing same general points on the Super Phenix core, the performances of fuel essemblies, the remainder of this discussion will deal with the manufacture by the CFCa of the first charge of fuel assemblies. The following aspects are considered in sequence - contract - production facilities - manufacturing procedures finally a few assessments will be presented.

30848 (CEA-CONF–9759) **Alternative fuels for the French fast breeder reactors programme.** Bailly, H.; Bernard, H.; Mansard, B. CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI). 1988. 11p. (CONF-881286–: Symposium on Nuclear Fuel Fabrication (NUFFAB '88), Bombay, Indiana, USA, 12-14 Dec 1988). Order Number DE89770508/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

At the present time, due to the very competitive cost per kWh produced in France by the PWRs, it appears clear that, despite the improved use of uranium by FBRs, they will only be developed if the cost of the fuel cycle is sufficiently lower than that of the PWRs to compensate for the additional investment. The current economic programme has fixed the following fuel related objectives: - burn-up as high possible, the value of 150 000 MWd/t being considered as a minimum, and not a final target to be achieved, - extension of the duration of reactor operation cycles, leading to high in-pile times for fuel. Reaching the latter objective depends on obtaining high internal breeding gain performances, so that the total reactivity drop related to fuel impoverishment can be minimized. In this respect, a large diameter oxide fuel and/or an axial heterogeneous core concept can be envisaged. Dense fuels could form another solution. The feasibility of the fabrication of carbide and nitride fuels has been demonstrated in several countries and there is currently convergence towards a single type of process based on a carbothermic reaction. The optimization of fabrication procedures for these fuels must be continued to satisfy economic requirements and to obtain a

fabrication cost of the same order or magnitude as that of oxide, although higher. If this target is achieved, fabrication will not be the major criterion for the selection of the FBR fuel, which will then be a function of the cost of reprocessing, performances under irradiation and reactor operating requirements.

30849 (CONF-890425–3) **Evolution of the liquid metal reactor: The Integral Fast Reactor (IFR) concept.** Till, C.E.; Chang, Y.I. Argonne National Lab., IL (USA). 1989. 4p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From American power conference; Chicago, Illinois, USA; 24-26 Apr 1989. Order Number DE89012398/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Integral Fast Reactor (IFR) concept has been under development at Argonne National Laboratory since 1984. A key feature of the IFR concept is the metallic fuel. Metallic fuel was the original choice in early liquid metal reactor development. Solid technical accomplishments have been accumulating year after year in all aspects of the IFR development program. But as we make technical progress, the ultimate potential offered by the IFR concept as a next generation advanced reactor becomes clearer and clearer. The IFR concept can meet all three fundamental requirements needed in a next generation reactor. This document discusses these requirements: breeding, safety, and waste management. 5 refs., 4 figs.

30850 (HEDL-SA–3713) **Mixed oxide fuel development.** Leggett, R.D.; Omberg, R.P. Hanford Engineering Development Lab., Richland, WA (USA). 8 May 1987. 10p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76FF02170. (CONF-870917–15: ANS/ENS international conference on fast breeder reactor systems: experience gained and path to economical power generation, Richland, Washington, USA, 13-17 Sep 1987). Order Number DE89011855/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the success of the ongoing mixed-oxide fuel development program in the United States aimed at qualifying an economical fuel system for liquid metal cooled reactors. This development has been the cornerstone of the US program for the past 20 years and has proceeded in a deliberate and highly disciplined fashion with high emphasis on fuel reliability and operational safety as major features of an economical fuel system. The program progresses from feature testing in EBR-II to qualifying full size components in FFTF under fully prototypic conditions to establish a basis for extending allowable lifetimes. The development program started with the one year (300 EFPD) core, which is the FFTF driver fuel, continued with the demonstration of a two year (600 EFPD) core and is presently evaluating a three year (900 EFPD) fuel system. All three of these systems, consistent with other LMR fuel programs around the world, use fuel pellets gas bonded to a cladding tube that is assembled into a bundle and fitted into a wrapper tube or duct for ease of insertion into a core. The materials of construction progressed from austenitic CW 316 SS to lower swelling austenitic D9 to non swelling ferritic/martensitic HT9. 6 figs., 2 tabs.

30851 (INIS-BR–1510) **Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus.** Vaz Junior, M.; Colle, S. Associacao Brasileira de Ciencias Mecanicas, Rio de Janeiro, RJ (Brazil). 1986. 4p. (In Portuguese). (CONF-8612138–: 1. national meeting on thermal sciences, Rio de Janeiro, RJ, Brazil, 10-12 Dec 1986). Order Number DE89614482/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The present paper reports a boundary integral solution analysis of a countercurrent heat exchanger made of a double-finned annulus. The enhancement of the heat transfer surface is obtained by longitudinal straight finns which are placed on the intermediate surface. The Nusselt number is compared with data obtained from analytical solution available for limiting-cases.

2107 Regulation and Licensing

Refer also to citation(s) 30607, 30824

30852 (NUREG–0386-Digest-5-Rev.1) **United States Nuclear Regulatory Commission staff practice and procedure digest: Commission, Appeal Board and Licensing Board decisions, July 1972–September 1988.** Nuclear Regulatory Commission, Washington, DC (USA). Office of the General Counsel. Apr 1989. 549p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A23/MF A01 - GPO - OSTI.

This Revision 1 of the fifth edition of the NRC Staff Practice and Procedure Digest contains a digest of a number of Commission, Atomic Safety and Licensing Appeal Board, and Atomic Safety and Licensing Board decisions issued during the period from July 1, 1972 to September 30, 1988 interpreting the NRC's Rules of Practice in 10 CFR Part 2. This Revision 1 replaces in part earlier editions and supplements and includes appropriate changes reflecting the amendments to the Rules of Practice effective through September 30, 1988.

30853 (NUREG–0540-Vol.2-No.3) **Title list of documents made publicly available, March 1–31, 1989.** Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. May 1989. 406p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A18/MF A01 - GPO - OSTI.

The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979. Microfiche of the docketed information listed in the Title List is available for sale on a subscription basis from the National Technical Information Service (NTIS).

30854 (OEVS-Mitteilung–1988, pp. 28-32) **Implementing optimization principle in the design of nuclear power plants: regulatory trends in Italy.** Benassai, S. (ENEA/DISP (Italy)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

As requested by the 1981 National Energy Plan, ENEA/DISP, the Italian regulatory authority, has been deeply involved in setting up of general design criteria for the future nuclear power plants (NPP). The purpose of the criteria is to guarantee the absence of undue risk for the workers and general public arising from exposure to ionizing radiation, and in this framework the application of the optimization principle plays a relevant role. 1 fig., 1 tab.

2108 Economics

Refer also to citation(s) 30792, 31037

30855 (INIS-GB–192) **Nuclear power and the greenhouse effect. UKAEA memorandum to the House of Commons Select Committee on Energy.** UKAEA Headquarters, London (UK). 1 Feb 1989. 13p. Order Number DE89617451/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Carbon dioxide from fossil fuel combustion accounts for about 40% of the global warming due to the 'greenhouse effect'. Thus national energy policies of the fuels used to generate electricity can have a significant effect on the levels of gas emissions which contribute to the 'greenhouse effect'. The more efficient use of energy is the first way of controlling the increase in gas emissions. The use of natural gas instead of coal or oil would also be beneficial but the reserves of natural gas are limited. The use of nuclear-generated electricity has already reduced the level of global warming by 3% but could have a greater effect in the future. Ways in which the government could reduce 'greenhouse' gas emissions are listed. These

include the more extensive use of nuclear power for generating electricity not only for domestic but industrial uses. (U.K.).

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory and Calculation

Refer also to citation(s) 30894, 30896, 32645, 32991, 32992, 32993, 32994, 32995

30856 (CEA-CONF–9695) **French studies for improvement of the data for radioactive sources.** Duchemin, B.; Nimal, B.; Nimal, J.C.; Blachot, J.; Chouha, M. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1988. 6p. (CONF-880906–: 7. international conference on radiation shielding, Bournemouth, UK, 12-16 Sep 1988). Order Number DE89760575/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The 1987 version of the CEA radioactivity data bank is just distributed. This data bank is used to compute concentrations, activities, β and γ spectra, which give sources for shielding purposes. To improve this data bank at short cooling time ($t < 200$ sec) a methodology based on the statistical model is used to take account of the upper unknown levels. To give an example of the results we get, a brief summary of the studies we made for the TCHERNOBYL case is given.

30857 (CONF-890406–17) **The relationship between integral experimental data and nuclear fission parameters.** Poenitz, W.P. Argonne National Lab., Idaho Falls, ID (USA). 1989. 32p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Fifty years with nuclear fission conference; Gaithersburg, Maryland, USA; 25-28 Apr 1989. Order Number DE89012394/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

High sensitivities of critical assembly and reactor design parameters to the fission cross sections, prompt and delayed neutron yields, and fission spectra parameters have resulted in an important role of experimental integral data for the testing and verification of differential data and computational methods. The higher accuracy of the experimental integral data compared with the uncertainties of reactor parameters which result from the uncertainties of the differential data has led to their utilization in data adjustment procedures. Improvements of up to a factor of ten are obtained for reactor parameters, however, the uncertainties of the basic data are reduced by smaller amounts. Other integral data like the fission spectra averaged cross sections are used for the evaluation of cross sections and fission spectra. 33 refs., 4 figs., 4 tabs.

30858 (CTA-EAv-ENU-FR–002/81) **Calculation of nuclear parameters for some heavy isotopes.** Corcuera, R.P.; Pinheiro, A.M.B.S. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais. 22 May 1981. 30p. (In Portuguese). Order Number DE89614330/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Some integrals are calculated using different weighting functions, the basic data come from two different nuclear data libraries, ENDF/B IV and ENDL/78. Significant discrepancies are found when are or the other lirary are used.

30859 (CTA-EAv-IS–007/80) **Program of evaluations for nuclear data centers.** Cunha Menezes Filho, A. da. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais. 1980. 18p. (In Portuguese). Order Number DE89614331/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Standard problems for evaluating basic data libraries of multigroup constant generation, and codes for calculating integral parameters existing or will exist in the near future in the advanced study division (EAV), are defined. (M.C.K.).

30860 (CTA-IEAv-ENU-FR–016/82) **Generation of one energy group cross section library with MC/sup 2/computer code.** Cunha Menezes Filho, A. da; Souza, A.L. de. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. 24 Nov 1982. 11p. (In Portuguese). Order Number DE89614332/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

One group temperature dependent cross sections are generated via MC/sup 2/for Pu-242, Ni-58, Fe-56, U-235, U-238, Pu-239, Pu-240, Pu-241, Be-9 e Th-232. The influence of the buckling and the weighting functions is studied throught calculations of an important integral parameter: the critical radius.

30861 (CTA-IEAv-NT–007/88) **Implantation of multigroup diffusion code 2DB in the IEAv CDC CYBER 170/750 system, and its preliminary evaluation.** Prati, A.; Anaf, J. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Sep 1988. 25p. (In Portuguese). Order Number DE89614727/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The IBM version of the multigroup diffusion code 2DB was implemented in the IEAv CDC CYBER 170/750 system. It was optimized relative to the use of the central memory, limited to 132 K-words, through the memory manager CMM and its partition into three source codes: rectangular and cylindrical geometries, triangular geometry and hexagonal geometry. The reactangular, triangular and hexagonal geometry nodal options were revised and optimized. A fast reactor and a PWR type thermal reactor sample cases were studied. The results are presented and analized. An updated 2DB code user's manual was written in Portugueses and published separately.

30862 (CTA-IEAv-RI–006/83) **Review of unresolved resonance treatments in multigroup processing computer codes.** Leite, S.B.; Rocamora Junior, F.D. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. 1983. 16p. (In Portuguese). Order Number DE89614333/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A review of unresolved resonance treatments used by MC/sup 2/, NJOY, ETOG, SUPERTOG, XLACS, HAMMER, and MC/sup 2/-II computer codes for generating multigroup constants is presented, and some approximations are commented. (M.C.K.).

2202 Components and Accessories

Refer also to citation(s) 31201, 31205, 31653, 32784

30863 (CEA-CONF–9717) **Expert systems for analysis and management assistance of nuclear reactor electrical power supplies.** Evrard, J.M.; Souchet, Y. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1988. 14p. (CONF-8811206–: Conference on methods and tools of nuclear plants safety operations, Paris, France, 30 Nov - 1 dec 1988). Order Number DE89770509/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Electrical power supplies of nuclear plants are very complex systems. They are studied in many ways: failure consequences, probabilistic risk assessement, failure diagnosis, corrective actions in case of incident ... Knowledge base technology (expert systems) is very suited to solve these problems. A common structural representation can generate specific functional representations; thus we get coherency and easy evolution. This paper shows a two facet methodology: the plant description (both static and dynamic) and reasoning about it. Current applications are developed for pressurized water reactors and gas cooled reactors, using the SPIRAL expert system shell buil at CEA.

30864 (CONF-860905–Vol.1, pp. 674-687) **Radiation effects on fiberoptic signal transmission systems.** Matsubara, T. (Sumitomo Electric Industries, Ltd., (Japan)); Watanabe, M.; Okuda, H.; Tanimoto, M.; Kashihara, H.; Fujita, Y.; Abe, N. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Radiation hardened fiberoptic systems are now being installed in nuclear facilities in Japan. The optical fibers of these systems differ from ordinary fibers, and are composed of a pure silica core and a

fluorine containing silica cladding. This advanced composition was invented in Japan. Fiberoptic systems consist of light emitting diodes, photo diodes and other components as well as optical fibers. By submitting each part to irradiation tests, the best radiation hardened components were selected. Applications of radiation hardened fiberoptic systems in Japan are described.

30865 (EPRI-ER–6345) **Microbial corrosion: 1988 workshop proceedings.** Licina, G.J. (ed.). Electric Power Research Inst., Palo Alto, CA (USA); Structural Integrity Associates, San Jose, CA (USA). c Apr 1989. 252p. Sponsored by Electric Power Research Institute. (CONF-8810369–: Workshop on microbial induced corrosion, Charlotte, North Carolina, USA, 18 Oct 1988). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A workshop on Microbial Induced Corrosion was held in Charlotte, North Carolina on October 18, 1988, hosted by the Electric Power Research Institute. The primary objective was to present an authoritative discussion of MIC for dissemination to the electric power generating community. Industry experts discussed fundamental aspects of MIC, methods for destructive and nondestructive examination, and various approaches for the mitigation of MIC damage. Examinations of the electrochemical, microbiological, and local chemical (as influenced by biofilms) aspects of MIC were included in the presentations on fundamental aspects of MIC. The two papers on diagnostic methods discussed advances in electrochemical methods for laboratory studies of MIC and presented guidelines for planning and conducting a detailed chemical, metallurgical, and microbiological analysis of failure sites where MIC is suspected. Cleaning, water treatment, design and operational considerations, and materials selection were each addressed in detail in discussions of methods for the mitigation of MIC. The information exchange provided additional direction to utility personnel and to EPRI for future activities toward the understanding and solution of MIC related problems. Individual projects are processed separately for the data bases.

30866 (EPRI-NP–5286) **Preliminary assessment of an inflatable inspection probe: Phases 1 and 2.** Schiltz, D.C.; Schneider, W.R. Electric Power Research Inst., Palo Alto, CA (USA); Battelle Columbus Labs., OH (USA). c Jul 1987. 54p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Fitting an eddy-current test probe for steam generator tubing with an inflatable bladder could increase coverage and improve inspection sensitivity. This report describes two preferred designs for an inflatable probe and recommends possible construction materials and manufacturing processes. 4 figs., 5 tabs.

30867 (EPRI-NP–6384-D) **Freeze sealing (plugging) of piping: A guide for nuclear power plant maintenance personnel.** DeLong, T.; Patel, B.; Galanti, P.; Howard, G. Electric Power Research Inst., Palo Alto, CA (USA); Bechtel Power Corp., San Francisco, CA (USA); Freeze Technology International, Inc., Houston, TX (USA). c Feb 1989. 66p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This is a reference manual designed to assist plant maintenance personnel in evaluating the use of freeze seals. In nuclear power plants, particularly in the primary plant, the use of freeze seals for isolation of equipment or systems should be limited to those cases when conventional means are not practicable. Using this guide, individuals can determine whether a freeze plug could be a safe and economical way to isolate a system for maintenance. This manual also provides valuable guidance for use during freeze sealing applications. It does not, however, provide complete instruction for the installation or operation of the freeze sealing equipment, and it cannot cover all possible applications or solutions to potential problem areas. Because of these particulars and the hazards involved in this technology, individuals in engineering and those assigned to apply freeze seals must be trained and qualified to operate the equipment and perform the application techniques.

30868 (INIS-BR–1462) **Cold forming degree and heat treatment on Wste 26 dished head.** Hamel, H.J.E.; Correa, F.P.R. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 8p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89614347/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

For the first heads of vessels for nuclear use in Brazil the problem of determination of cold forming degree and the effects of cold deformation on the mechanical properties as well as the heat treatment criteria are discussed.

30869 (INIS-BR–1467) **Integrity of austenitic stainless steel piping welds for nuclear service.** Canalini, A.; Lopes, L.R. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 10p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89614348/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A criterion applying K/sub 1d/concept was developed to determine the fracture mechanics properties of austenitic stainless steel nuclear piping welds. The critical dimensions, lenght and depth, for crack initiation were established and plotted in a chart. This study enables the dimensions of a discontinuity detected in an in-service inspection to be compared to the critical dimensions for crack initiation, and the indication can be judged critical or non-critical for the component.

30870 (ORNL/tr–89/7) **Arrangement for cooling a nuclear power plant.** Fredell, J. ASEA-ATOM AB, Vaesteraas (Sweden). 1989. 8p. Translation of German Patent No. 3,719,062 A1, January 21, 1988. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89008816/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Arrangement for cooling a nuclear power plant, which includes a reactor core, a reactor pressure vessel and a containment. A cooling system is connected to the reactor building and is capable of automatically supplying coolant such as cold water to the reactor building, depending on the pressure difference between the coolant feed stream and the pressure in the reactor building. The reactor building is protected and the effects of a loss of coolant accident in the reactor are limited by the system according to this invention. 2 figs.

2203 Fuel Elements

Refer also to citation(s) 30631

30871 (RISO-FGP-R–14-Rev.) **Irradiation data for bump tests 1-11: Risoe Fission Gas Project: Revision.** Knudsen, P.; Misfeldt, I.; Bagger, C.; Hansen, K. Risoe National Lab., Roskilde (Denmark). Jun 1983. 33p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34033. Order Number DE89011603/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

This report describes the details of the bump irradiation for the 11 bump tests performed in the Risoe Fission Gas Project. This report explains the procedure of the bump testing and presents the detailed pin power histories, with information on axial and radial power profiles. Expressions are also given for the cladding surface temperature and the fast flux in the cladding. The present report replaces previous documents giving interim reports on the progress of the bump test program. 6 refs., 11 figs., 3 tabs.

30872 (RISO-FGP-R–16) **Puncturing results and plenum spectrometry on IFA 148 pins and bump tests 1-11: Risoe Fission Gas Project.** Carlsen, H.; Bagger, C.; Mikkelsen, C.; Olesen, P.B. Risoe National Lab., Roskilde (Denmark). Mar 1982. 18p. Sponsored by DOE Nuclear Energy. DOE Contract FG06-80ET34033. Order Number DE89011605/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

Of the 12 fuel pins used in the Project, 3 unbumped and 7 bump tested pins have been punctured and the data are given in the present report. It has been agreed that results for the remaining two pins (G32-3, J7-3) will be made available at a later stage, when they have been punctured in connection with work outside the Project scope. The relative concentration of fission gases in the plenum

area of the 12 intact fuel pins was assessed non-destructively by gamma spectroscopy. The measurement was repeated on each pin bump tested. By calibration from puncturing results, the relative fission gas concentrations were converted to absolute amounts of fission gas. The plenum spectrometry section of the report evaluates the measurements carried out, to give the fission gas release accumulated by the pins in the Halden Boiling Water Reactor (HBWR) (pre bump irradiation) and the fission gas releases obtained from further irradiation in DR 3, for pins where puncturing has not been possible. In addition, plenum spectrometric measurements, calibrated by the first few puncturing results, have been useful for quick interim assessment of the fission gas content, until the further puncturing results became available. 5 refs., 9 tabs.

30873 (STUDSVIK-STSRX–9) **Ceramography of AA test fuel rods OA1-1, OA1-2 and OL1-4: The Super-Ramp Extension Project.** Birath, S. Studsvik Energiteknik AB, Nykoeping (Sweden). Feb 1985. 28p. Sponsored by DOE Nuclear Energy. DOE Contract FG01-84NE34122. Order Number DE89012716/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.

Ceramography was performed on one longitudinal sample from each of the non-failed rods OA1-1, OA1-2 and OL1-4. The position of the sample was in all three cases the maximum ramp power position of the rod. Photos were taken showing the fuel in polished as well as in etched condition. As the stated grain size values of the two lots of pellets involved did not agree with the findings at the PIE two archive pellets, one from each lot, were also examined to measure the as fabricated grain size.

2204 Control Systems

30874 (CTA-IEAv-RP–019/88) **Pseudo-harmonics method: an application involving perturbations caused by control rod insertion in PWR reactors.** Claro, L.H.; Alvim, A.C.M.; Thome, Z.D. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Aug 1988. 9p. (CONF-870424–: American Nuclear Society international meeting on advances in reactor physics, mathematics and computation, Paris, France, 27-30 Apr 1987). Order Number DE89614334/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The objective of this work is to stydy the effect of intense perturbations, such as control rod insertion in the core of PWR reactors, through a perturbation approach consisting of a modified version of the pseudo-harmonics method. A typical one-dimensional PWR reactor model was used as a reference state, from which two perturbations were imposed, simulation gray and black control rod insertion. In the first case, eigenvalue convergence was achieved with the eighth order of approximation approximation and perturbed fluxes and eigenvalue estimates agreed very well with direct calculation results. The second case tested represents a very intense localized perturbation. Oscillation in keff were observed er of approximation increased and the method failed to converge. Results obtained indicate that the pseudo-harmonics method can be used to compute 2 group fluxes and fundamental eigenvalue of perturbated states resulting from gray control rod insertion in PWR reactors. The method is limited, however, by perturbation intensity, as other perturbation methods are.

30875 (DP-MS–88-235) **Design and testing of a heated thermocouple liquid level probe.** Levin, A.E.; Schneider, A.; Harris, J.D. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant. 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. (CONF-890604–2: Annual meeting of the American Nuclear Society, Atlanta, Georgia, USA, 4-8 Jun 1989). Order Number DE89007233/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During a reactor accident involving loss of coolant inventory, it is important to know the liquid level inside the reactor. Several techniques are available to accomplish this type of measurement, including pressure sensors, floats, and acoustic devices. Another technique involves the use of a directly or indirectly heated thermocouple to determine changes in the heat transfer coefficient on the outer surface of a level probe, such as would occur when a drop in liquid level exposes the probe to a gaseous environment. This paper presents the design and data from the testing of a thermal liquid level sensor, using an indirectly heated thermocouple. The probe has been specifically designed for use in the heavy water cooled and moderated reactors at the Savannah River Plant (SRP). 2 figs.

30876 (EPRI-NP–6379) **Expert training systems to enhance plant operations decision making: Final report.** Pack, R.; Lazar, P.; Schmidt, R. Electric Power Research Inst., Palo Alto, CA (USA); General Physics Corp., Columbia, MD (USA). c May 1989. 92p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Expert systems offer the potential for enhancing power plant operations by improving the performance of the plant operations staff and other utility personnel. Expert systems, and specialized expert training systems, can improve the training of plant personnel. This report surveys the current and potential applications of expert training systems for enhanced operations decision making in nuclear power plants. It also provides guidelines for the development of expert training systems for those applications. As an example of the use of expert training systems, it shows how the modification and application of an existing system can support training needs. 45 refs.

30877 (NUREG/CR–5274) **Numerical simulation of natural circulation phenomena in a PWR during TMLB' transients prior to core damage.** Cha, Y.S.; Domanus, H.M.; Liu, K.V.; Schmitt, R.C.; Sha, W.T.; Shah, V.L. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Accident Analysis; Argonne National Lab., IL (USA). May 1989. 270p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. (ANL–88-47). Available from NTIS, PC A13/MF A01 - GPO - OSTI.

Multidimensional thermal-hydraulic simulation of natural circulation phenomena during a TMLB' transient prior to core damage has been performed by using the COMMIX computer code. Both a three-loop and a four-loop PWR plant are analyzed. Effects of various parameters on natural circulation are investigated. The most important result is that natural circulation exists during a TMLB' transient for all the cases investigated so far. 190 figs., 34 tabs.

2205 Environmental Aspects

Refer also to citation(s) 30629, 30849, 30891, 30892, 30915, 32012, 32014, 32015, 32018, 32019, 32020, 32074, 32361, 32362, 32377, 32418, 32779, 32780

30878 (BARC–1420) **Data base pertinent to earthquake design basis.** Sharma, R.D. Bhabha Atomic Research Centre, Bombay (India). 1988. 74p. Order Number DE89616243/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Mitigation of earthquake risk from impending strong earthquakes is possible provided the hazard can be assessed, and translated into appropriate design inputs. This requires defining the seismic risk problem, isolating the risk factors and quantifying risk in terms of physical parameters, which are suitable for application in design. Like all other geological phenomena, past earthquakes hold the key to the understanding of future ones. Quantificatio n of seismic risk at a site calls for investigating the earthquake aspects of the site region and building a data base. The scope of such investigations is il lustrated in Figure 1 and 2. A more detailed definition of the earthquake problem in engineering design is given elsewhere (Sharma, 1987). The present document discusses the earthquake data base, which is required to support a seismic risk evaluation programme in the context of the existing state of the art. (author). 8 tables, 10 figs., 54 refs.

30879 (INIS-BR–1458, pp. 148) **Environmental radioactivity.** Eisenbud, N. (New York Univ., NY (USA). Medical Center). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

NUCLEAR FACILITIES/environmental impacts

30880 (INIS-BR–1484) **Nuclear energy and the environment.** Ferraz, E.S.B. Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil). 1988. 2p. (In Portuguese). (CONF-881289–: 2.

week of environment, Piracicaba, Brazil, 5-9 Dec 1988). Order Number DE89613840/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

NUCLEAR ENERGY/environmental impacts

30881 (INIS-mf-11406, pp. 89) **Role de la radioecologie dans l'evaluation de l'impact des activites nucleaires dans l'environnement.** Grauby, A. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Service d'Etudes et Recherches sur l'Environnement). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, Israel, 24-30 Oct 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NUCLEAR FACILITIES/environmental impacts; NUCLEAR INDUSTRY/radioecology; RADIOECOLOGY; RADIOECOLOGICAL CONCENTRATION

30882 (OEVS-Mitteilung–1988, pp. 539-543) **Developments in environmental monitoring.** Gould, J.L. (GEC Energy Systems Ltd., Leicester (UK)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Environmental monitoring equipment has developed from large air ionising chambers, through atmospheric-pressure tissue-equivalent gas-filled ion chambers, film and TLD badges and GM tubes, to on-line real-time recording systems. These systems provide plant operators with direct readings of the environmental impact of routine releases and allow fast and informed action in the event of an accidental release. 8 refs., 4 figs.

30883 (OEVS-Mitteilung–1988, pp. 531-534) **Aspects of controlling the radioactive waste water released by nuclear power plants at the Paks NPP.** Viragh, E. (Nuclear Training Reactor of BTU, Budapest (Hungary)); Molnar, F.; Rosa, G.; Szabo, I.C. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Two WWER-440 type pressurized water reactor units are working now at Hungary near Paks, cooled by the Danube river. The aspects of controlling the radioactive effluent waters are treated in the article, and some characteristic data for the releases at the past three years are presented. 2 refs., 1 fig., 2 tabs.

30884 (OEVS-Mitteilung–1988, pp. 699-703) **Monitoring of the /sup 14/C activity in the environment of the nuclear power plant Krsko in Yugoslavia.** Obelic, B. (Institut Rudjer Boskovic, Zagreb (Yugoslavia)); Krajcar-Bronic, I.; Srdoc, D.; Horvatincic, N. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Measurements of /sup 14/C activity of atmospheric carbon dioxide, vegetables and tree rings have been performed in the surroundings of the nuclear power plant Krsko in Yugoslavia since 1984. An average excess of 2% above the reference point activity was observed 1,5 km from the plant smokestack during normal periods of reactor operation. No influence of the power plant radiocarbon release was observed on the tree ring activity. Calculations of the /sup 14/C release from the power plant was estimated at 0,1 TBq/a. No general increase of atmospheric /sup 14/C activity was observed after the Chernobyl accident, even though during short sampling periods the /sup 14/C activity increased up to 20% above the pre-accident activity. 4 refs., 3 figs.

30885 (SAAS–365) **Recommendations for the determination of migration parameters by field experiments (tracer tests).** Adam, C.; Victor, N. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 60p. (In German). Order Number DE89616597/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The hydrogeologic review and assessment of candidate sites for nuclear power plants includes expertises on the potential subsurface migration of radionuclides in the event of accident conditions. To this end, knowledge of representative migration parameters is required. Detailed recommendations are given for determining such parameters by tracer field tests, for using standardized terminology in their practical conduct as well as for interpreting the data obtained. Also, mention has been made of recent work reported by other authors on this topic. 31 refs.

30886 (SNV–3462) **Influence of cooling water outlet of the Ringhals power plant on the coastal fish colony.** Neuman, E. National Swedish Environmental Protection Board, Solna (Sweden). Mar 1988. 25p. (In Swedish). Order Number DE89613842/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Fish abundance has been monitored with fyke nets in 1976-1987 at the cooling-water outlet from the Ringhals nuclear power plant at the Swedish west coast and in a reference area. Judging from the dependence of the catches on temperature, Myoxocephalus scorpius, Zoarces viviparus, Gadus morhua and Platichtys flesus can be classified as cold-water species and Symphodus melops, Ctenolabrus rupestris, Carci nus maenas and Anguilla anguilla as warm-water species. As a rule the warm-water species were more and the cold-water fishes less abundant in the outlet area than in the reference area. The catch of the economically important Anguilla was about three times greater in the heated area. A lower abundance than expected of Ctenolabrus and Myoxocephalus at the outlet may be caused by a loss of eggs and larvae in the cooling-water system.

30887 (SNV–3463) **Biological and radioecological investigations at Ringhals nuclear power plant 1968-1987.** Grimaas, U.; Jacobsson, A.; Neuman, E. National Swedish Environmental Protection Board, Solna (Sweden). Mar 1988. 26p. (In Swedish). Order Number DE89613838/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report is compilated from 19 investigations dealing with fish, fauna, planktons, algae and occurrence of radioactivity in water and on land. The investigations deal with experiences from 12 operational years of which the station has been fully operational during the last four. Concerning fisheries the direct effects from the cooling water system upon fish in various stages of development has been assumed to be of importance. Radioactivity from water has been traced in organisms and sediments in the area. Contents of different radionuclides emanating from the operation of the power station are highest in algae and lowest in fish tissues. The results provide a base for calculations of radiation dose to man. (L.F.).

30888 (SSI–87-29) **Intercalibration measurements of gamma radiating nuclides.** Suomela, J. National Inst. of Radiation Protection, Stockholm (Sweden). 23 Sep 1987. 13p. (In Swedish). Order Number DE89613846/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Comparison of gamma spectrometric analyses of water-, filter- and bottom samples has been performed at a number of Swedish nuclear engineering plants and institutions. The report presents in tabular form the results from the analyses. (L.F.).

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 30899, 30913, 30916, 31632

30889 (INIS-BR–1458, pp. 57) **Measurement of the neutron-spectrum in the IEA-R1 research reactor.** Bitelli, U.D. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Maiorino, J.R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7

Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

IEAR-1 REACTOR/fuel elements; IEAR-1 REACTOR/neutron spectra; COMPUTER CALCULATIONS; FOILS; H CODES; IRRADIATION; NEUTRON REACTIONS; S CODES; TEMPERATURE MEASUREMENT

30890 (NUCLEBRAS-CDTN–603) **25/sup th/birthday of the first criticality of IPR-R1 nuclear research reactor.** Tofani, P.C.; Stasiulevicius, R.; Roedel, G. Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil). 1988. 10p. (In Portuguese). Order Number DE89614491/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The historical evolution of IPR-R1 research reactor of Instituto de Pesquisas Radioativas-Nuclebras, since the data of its first criticality, is presented. The modifications and the main activities carried out, are presented. (M.C.K.).

30891 (OEVS-Mitteilung–1988, pp. 391-395) **Quarter century operational radiation protection at the Atominstitute.** Tschirf, E. (Atominstitut der Oesterreichischen Universitaeten, Vienna (Austria)); Tschurlovits, M.; Slanetz, H. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A review is given on the work of the radiation protection group of the Atominstitute since the start of operation in 1962. In the beginning, the work was focussed to preoperational measurements at the reactor site, and the introduction of radiation protection measures for different radiation sources and laboratories, where no legal provisions were existing at that time. Later the work has to be grouped into the following main issues, management and personal monitoring of occupationally exposed persons and physical surveillance of workplace, monitoring of releases of the triga mark 2 reactor and surveillance, waste management and environmental monitoring. The task mentioned above lead to the requirement of the solution of many in some cases unexpected problems which are associated with the operation of radiation protection in an university institute with a large number of fluctuating persons. 4 refs., 3 figs.

30892 (OEVS-Mitteilung–1988, pp. 399-403) **Reducing radiation doses at a 10MW research reactor.** Mueck, K. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. (Austria)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The accumulating activity inventory, corrosion and wear at a 25-year old reactor usually are expected to increase the occupational radiation exposure of the reactor staff. In addition to that, the power operation of the reactor has increased from approximately 40MWd/a in the first years to 760MWd/a in 1970 and 860MWd/a in 1985. The activity of radioisotopes produced per year has increased approximately by a factor of 16 in the last 15 years. In spite of these facts, the average occupational exposure could be reduced by more than 60% in the last 15 years, the maximum single dose by more than 70%. The major aspects which contributed to achieve this reduction, will be discussed as well as the obstacles encountered. A brief description of the efforts and the success in reducing the gaseous releases to the environment to 10% of the original release value will be also given. 5 figs., 1 tab.

30893 (OEVS-Mitteilung–1988, pp. 444-448) **Radiation protection aspects of rebuilding the Berlin research reactor (Ber 2).** Borchardt, D. (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Abt. Strahlenschutz); Hacke, J.; Mundt, R.; Soltau, H. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The old reactor has been in operation since 1973. Now, in 1985 to 1987 the reactor should be rebuilt in order to increase its power from 5 to 10 MW and to improve the experimental facilities. Radiation protection aspects and experiences in the preparatory phase and during dismantling of all components not to be used furtheron, are described. 25 members of the Hahn-Meitner Institute and of foreign companies participated in the dismantling. An activity of 1,8.10/sup 8/MBq was processed during this period and a collective dose of 25mSv consumed. 5 figs., 1 tab.

2207 Plutonium and Isotope Production Reactors

30894 (PNL–6877) **Tritium distribution modeling in a Light Water New Production Reactor.** Jaeckle, J.W. Pacific Northwest Lab., Richland, WA (USA). May 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE89012236/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The tritium distribution and tritium release pathways in a new light water production reactor were examined. A computer model was developed to track the tritium as it makes its way through the various plant systems and ends up either as a release to the atmosphere, the cooling tower blowdown or to the solid waste system. The model was designed to predict the integrated yearly tritium releases and provide estimated airborne tritium concentrations in various locations within the plant. WNP-1 was used as a representative model for a Light Water New Production Reactor (LWNPR). The Tritium Distribution Model solves for the time dependent tritium concentration in a system of nodes. These nodes are connected to one another via a set of internodal flow paths and to various sources and sinks. For example, plant systems such as the primary system are the nodes, piping and leaks are the internodal flow paths, make-up water is a source, and release to the atmosphere is a sink. The expected water mass of each node; the flow rates between nodes, sources, and sinks; and tritium source rates are provided as input. The code will solve for the time dependent tritium concentration in each node and the amount of tritium "released" to the sinks. Preliminary calculations have been performed using WNP-1 plant specific information obtained primarily from the WNP-1 FSAR. Further work is currently in progress to refine the model and provide a more realistic set of input values which will better represent an operating LWNPR. 1 ref., 1 fig., 1 tab.

2209 Reactor Safety

Refer also to citation(s) 30849, 30870, 30877, 30893, 31003, 31591, 31844, 31847, 31983, 31987, 32007, 32016, 32377, 32389, 32771, 32773

30895 (BNL-NUREG–42259) **Occupational exposures and practices in nuclear power plants.** Baum, J.W. Brookhaven National Lab., Upton, NY (USA). 1989. 35p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (CONF-890485–1: 25. annual meeting of the National Council on Radiation Protection and Measurements, Washington, D.C., USA, 4-7 Apr 1989). Order Number DE89012546/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

As the first generation of commercial nuclear power comes to a close, it is timely to consider the status of occupational exposure in the power generation industry, that is, the collective occupational radiation doses received by workers in nuclear power plants. The picture is surprising. One might have thought that as newer, larger, and more modern plants came on line, there would be a significant decrease in exposure per unit of electricity generated. There is some indication that this is now happening. One might also have thought that the United States, being a leader in the development of nuclear power, and in the knowledge, experience and technology of

nuclear radiation protection, would have the greatest success in controlling exposure. This expectation has not been fulfilled. 32 refs., 4 figs., 5 tabs.

30896 (CNIC–00088) **Flux weighted method for solution of stiff neutron dynamic equations and its application.** Li Huiyun; Jiao Huixian. China Nuclear Information Centre, Beijing, BJ (China). Dec 1987. 17p. (In Chinese). (RINPO–0002). Order Number DE89614329/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

To analyze reactivity event for nuclear power plants, it is necessary to solve the neutron dynamic equations, which is a group of typical stiff constant differential equations. Very small time steps could only be adopted when the group of equations is solved by common methods. However, a large time steps might be selected if the Flux Weighted Medthod introduced in this paper is used. Generally, weighted factor θ/sub i1/is set as a constant. Naturally, this treatment method can decrease the accuracy of calculation for the increase of the steadiness of solving the equations. An accurate theoretical formula of 4 x 4 matrix of θ/sub i1/is rigorously derived so that the accuracy of calculation is ensured, as well as the steadiness of solved equations is increased. This method have the advantage over classical Runge-kutta Method and other methods. The time steps could be increased by a factor of 1 $\sim$ 3 orders of magnitude so as to save a lot of computating time. The programe solving neutron dynamic equation, which is prepared by using Flux Weighted Method, could be sued for real time analog of training simulator, as well as for analysis and computation of reactivity event (including rod jumping out event).

30897 (CONF-860905–Vol.1, pp. 616-623) **Decommissioning of the Niederaichbach Nuclear Power Station (KKN) - remote dismantling.** Loeschhorn, U. (Kernforschungszentrum Karlsruhe GmbH (West Germany)); Birkhold, U.; Obst, J.; Stasch, W. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The decommissioning of nuclear power plants unlike conventional plants raises a number of specific technical and economic problems, because of the radioactivity involved. These are, e.g., safety and licensing problems, protective measures against radiation, handling and dismantling of large activated components, dismantling, procedures and techniques, decontamination, release of material, transport and storage of large quantities of radioactive waste. Consequently, it is necessary to study the technical problems connected with decommissioning and remote operation of demolition tools. The Niederaichbach Nuclear Power Plant is a good example of demonstration; it was shut down in 1974, has already been transferred into the "safe enclosure" condition and its activity inventory is relatively low. It is intended to outline in this paper the demolition of the NPP with special regard given to automated or remotely handled tools. Procedures as well as equipment and some related experimental results are discussed.

30898 (CONF-860905–Vol.1, pp. 688-698) **TMI-2 reactor fuel removal, loading, transport, and storage.** Reno, H.W. (EG & G Idaho, Inc., Idaho Falls (USA)); Schmitt, R.C. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The accident at Unit 2 of the Three Mile Island Nuclear Power Station (TMI-2) resulted in a severely damaged reactor core. That presented the engineering and scientific communities with many challenges. Preparations and operations are highlighted for loading and transporting TMI-2 reactor core debris and receiving and storing that material at the Idaho National Engineering Laboratory (INEL). The phases of getting canisters from TMI to INEL are discussed. Lessons learned are indicated and benefits derived are noted.

30899 (DOE/EH–0073) **Technical Safety Appraisal of the Sandia reactors, ACRR [Annular Core Research Reactor], SPR III [Sandia Pulse Reactor III], Sandia National Laboratories, Albuquerque.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Safety Appraisals. May 1989. 202p. Sponsored by DOE Environment Health & Safety. Order Number DE89012252/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report presents findings and concerns resulting from a Technical Safety Appraisal of Sandia National Laboratories' Sandia Pulse Reactor III (SPR III) and the Annular Core Research Reactor (ACRR). It was conducted by an appraisal team for the Department of Energy's Office of Safety Appraisals during site visits July 18–22 and August 1–12, 1988. The two reactors are located in Technical Area V of the Sandia Albuquerque site. A third reactor, SPR II, is stored assembled in a vault at the SPR III facility. While the SPR II reactor is still considered operational, there are no plans to use it in the foreseeable future. It was last operated in 1984. This appraisal addresses only the operations associated with SPR III and ACRR. The principle hazards presented by operations in these facilities are routine industrial safety hazards, the beta and gamma radiation fields experienced during maintenance operations at SPR III and during the handling of experimental packages after irradiation in either of the reactors, and localized radiation fields that could result from a highly-unlikely, severe accident. The findings and concerns developed by the appraisal team were shared with senior managers of Sandia National Laboratories and the Albuquerque Operations Office in exit meetings held on August 11 and 12, 1988. The final report of the team has been validated for factual accuracy with Sandia and the Albuquerque Operations Office.

30900 (DP-MS–89-5) **PC-based calculation of activation energy using linear regression.** Bornt, F.W. Savannah River Lab., Aiken, SC (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. (CONF-890604–4-Vugraphs: Annual meeting of the American Nuclear Society, Atlanta, Georgia, USA, 4-8 Jun 1989). Order Number DE89010459/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During a severe accident, various plant locations will be subjected to harsh environments: high temperature, high humidity, high radiation, etc. Equipment required for accident mitigation located in these areas must be capable of withstanding these conditions, i.e., environmentally qualified. Qualification is normally accomplished by type-testing. The equipment undergoes accelerated aging to achieve a condition equivalent to the end-of-life condition. This aging consists of accelerated thermal aging and radiation aging. The aged equipment is then subjected to simulated seismic vibration and other vibration. After a radiation exposure simulating some maximum accident exposure, the equipment is then mounted in a test chamber and operated during a simulated design basis event (DBE) environment (high temperature, pressure, humidity, and possible submergence) and post-accident conditions. This paper describes two PC-based methods of applying the linear regression method to the thermal aging data to obtain an activation energy. 7 refs., 2 figs.

30901 (ENEA-RT-PAS–88-25) **Review of the nuclear safety activities in Italy.** Merelli, A. ENEA, Rome (Italy). 1989. 16p. (In Italian). Order Number DE89614346/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A review of research programs carried out in Italy in the field of nuclear reactor safety was done in 1986, in the frame of the activities of the Commission of the European Communities, the International Energy Agency and the Nuclear Energy Agency of the Organization for Economic Cooperation and Development. The report contains information on these programs, as well as information on the organization of safety research in Italy and the evolution of safety research programs.

30902 (EPRI-NP–6359-Vol.2) **Seismic margin assessment of the Catawba Nuclear Station: Volume 2, Appendixes: Final report.** Campbell, R.D.; Henley, B.F.; Shoemaker, W.; Kulla, D.; Buttemer, D.R.; McIntyre, T.; Moriwaki, Y.; Idriss, I.M. Electric Power Research Inst., Palo Alto, CA (USA); NTS Engineering, Long Beach, CA (USA); Duke Power Co., Charlotte, NC (USA); Pickard, Lowe and Garrick, Inc., Newport Beach, CA (USA); Woodward Clyde Consultants, Santa Ana, CA (USA). c Apr 1989. 665p.

Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A seismic margin assessment of the Duke Power Company Catawba unit 2 nuclear station showed the practicality of an EPRI-developed methodology for demonstrating the ability of nuclear plants to withstand earthquakes beyond design basis. The assessment established that the Catawba station would survive earthquake loads up to twice its design basis.

30903 (EUR–11373) **Final report on a study of coherence in acceptability criteria for the technical aspects of risks associated with potentially hazardous installations.** Chicken, J.C. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 58p. Available from NTIS (US Sales Only), PC A04/MF A01.

This report describes the results of the study that was made, under Contract No ECI-1390-B7221-85D, for the European Atomic Energy Community. The aim of the study was to examine and assess the feasibility of developing coherent and uniform criteria for judging the acceptability of the technical aspects of the risks associated with potentially hazardous installations. The report is arranged in five main parts. First the nature of hazardous installations is considered and this provides the basis for examination of the currently-used technical risk acceptability criteria. Next, the possible forms of criteria are explored and then universally consistent partial and overall technical risk acceptability criteria are proposed. Following this the implications of using the criteria proposed at the design, regulatory and operating levels are examined. Then, by testing the criteria against some real decisions, the practical problems of using the proposed criteria are explored. This leads to consideration of possible alternatives to the proposed criteria. Finally the conclusions that appear to be justified are summarized and the need for further work is identified.

30904 (GRS-F–171) **List of reports in the field of reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC. Reported period: 1 October - 31 December 1988.** Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.). Feb 1989. 67p. (In German). Order Number DE89774824/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning single problems in the field of reactor safety research. According to the cooperation of the Bundesminister fuer Forschung und Technology (BMFT) with the Commissariat a l'Energie Atomique (CEA), the Japan Science and Technologie Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Program of the BMFT, reporting organization. The list of reports appears quarterly.

30905 (INIS-BR–1465) **Provisions and active measures to preclude guillotine breaks in piping systems of pressurized water reactors.** Dorner, H.; Michel, E. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 10p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89614411/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The conditions and active measures which preclude a spontaneous failure of pipings are shown. With the basic safety concept a quality standard is achieved characterized by high-grade material properties, a structure that is adequate to the loads to which the components will be subjected in service and is amenable to inspection, precise load and stress evaluation, optimized manufacturing and operation monitoring. The possible failure types are described and the safety against failure is assessed.

30906 (Juel–2234) **Fission product release profiles from spherical HTR fuel elements at accident temperatures.** Schenk, W.; Pitzer, D.; Nabielek, H. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe. Sep 1988. 137p. Order Number DE89774819/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

With the construction of the cold finger apparatus, a new method has been developed to determine fission product release profiles during heating tests of irradiated spherical fuel elements. 22 fuel elements with modern TRISO particles have been tested in the temperature range of 1500-2500/sup 0/C. In addition, experiments were done on seven UO/sub 2/samples at 1400 to 1800/sup 0/C. For heating times up to 100 hours at the maximum temperature, the following results were obtained: silver is the only fission product to be released at 1200-1600/sup 0/C by diffusion through intact SiC, but is of low significance in accident scenarios; caesium, iodine, strontium and noble gas releases up to 1600/sup 0/C are solely due to various forms of contamination. At 1700-1800/sup 0/C, corrosion-induced SiC defects cause the release of Cs, Sr, I/Xe/Kr. Above 2000/sup 0/C, thermal decomposition of the silicon carbide layer sets in, while pyrocarbons still remain intact. Around 1600/sup 0/C, the accident specific contribution of caesium, strontium, iodine and noble gas release is negligible.

30907 (NEI-SE–38) **Standby after the Chernobyl accident.** Board of Accident Investigations, Stockholm (Sweden). Sep 1987. 530p. (In Swedish). Order Number DE89613823/JAW. Available from NTIS (US Sales Only), PC A23/MF A01 - OSTI; INIS.

Includes two seperate appendices.

The report is an investigation concerning standby and actions by SKI (Swedish Nuclear Power Inspectorate) and SSI (National Institute of Radiation Protection) due to the Chernobyl reactor accident. It consists of a final report and two appendices. The final report is divided into two parts: 'I: Facts' and 'II: Analyzes'. 'Facts': The Swedish model for information: radio, press. Basic knowledge about ionizing radiation in the society. Resources for information. Need for information. Message forms for information. Announcements from the authorities in TV, radio, press, meeting, advertisements. Statements concerning the reactor accident and its consequences in Swedish mass media. How did the public recieve the information? 'Analyzis': Information responsibilities and policies. SSI information activities concerning radiologic accidents, conditions, methods and resources. Ditto for SKI, Swedish National Food Administration and the National Board of Agriculture. Appendix I: Information from authorities in the press three weeks after the Chernobyl accident: The material and the methods. The acute phase, the adoptation phase, the extension of the persective. What is said about the authorities in connection with Chernobyl? Appendix II: The fallout from Chernobyl, the authorities and the media coverage: The nationwide, regional and local coverage from radio and television. Ditto from the press. Topic and problem areas in reporting. Instructions from the authorities in media. Contribution in the media from people representing the authorities. Fallout in a chronologic perspective. (L.F.).

30908 (NUREG–0896-Suppl.8) **Safety Evaluation Report related to the operation of Seabrook Station, Units 1 and 2 (Docket Nos. 50-443 and 50-444).** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation. May 1989. 91p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A05/MF A01 - GPO - OSTI.

This report is Supplement No. 8 to the Safety Evaluation Report (SER) (NUREG-0896, March 1983) for the application filed by the Public Service Company of New Hampshire, et al., for licenses to operate Seabrook Station, Units 1 and 2 (Docket Nos. STN 50-443 and STN 50-444). It has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission and provides recent information on open items identified in the SER. The facility is located in Seabrook, New Hampshire. Subject to favorable resolution of the items discussed in this report, the staff concludes that the facility can be operated by the applicant without endangering the health and safety of the public. 2 figs., 1 tab.

30909 (NUREG/CR–5351) **Models for pulmonary lethality and morbidity after irradiation from internal and external sources.** Scott, B.R.; Filipy, R.E.; Hahn, E.F. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.;

Pacific Northwest Lab., Richland, WA (USA). May 1989. 43p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76EV01013;AC06-76RL01830. (LMF–122). Available from NTIS, PC A04/MF A01 - GPO - OSTI.

This report provides a hazard-function model for estimating the risk of death from radiation pneumonitis and/or pulmonary fibrosis following a light-water nuclear power accident. A similar model is also provided for estimating the prevalence of respiratory functional morbidity among those that survive death from acute effects. Hazard-function models for lethality and for morbidity were constructed using the cumulative hazard estimator H, which is related to the risk estimator R through the equation R = 1-exp(-H). The estimator H can be calculated using information provided in the report. The method of calculation depends on the exposure scenario. In general, the total normalized dose X for lethality or for morbidity is calculated. For lethality, X = 1 corresponds to a median lethal dose (LD_{50}); for morbidity, X = 1 corresponds to a median effective dose (ED_{50}). H is related to X by the equation $H = 1n(2)X^V$, where V depends on the type of radiation (or radiations) involved. Contributions to X can arise from each of two main modes of exposure: (1) brief exposure of the lung, at a relatively high dose rate, to mainly external gammas, followed by (2) chronic internal alpha, and/or beta, and/or gamma irradiation of the lung. Equations are provided for calculating the contributions to X from both modes of exposure. 73 refs., 16 figs., 2 tabs.

30910 (OEVS-Mitteilung–1988, pp. 54-58) **How the emergency plans for reactor accidents should be revised.** Kroeger, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)); Ehrlich, H.G.; Jacquemin, J. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

With the present 2500 year of operating experience for the light-water reactors, a more realistic assessment of the risk of a reactor accident, of the scenarios, the release values and -times is possible. The emergency plans should be adapted accordingly. Dose guidelines for the initiation of particular protection measures, for food contamination and the criteria for resettlement in contaminated areas should be fixed. More weight should be given to the sheltering and evacuation should be restricted. The modification of emergency plans is exemplified with the THTR-300, a reactor with strongly increased passive safety. 7 refs., 1 fig. (qui).

30911 (OEVS-Mitteilung–1988, pp. 39-53) **Scientific basis for risk assessment and legal aspects of compensation of claims related to occupational and non-occupational radiation exposure.** Rockwood, L. (International Atomic Energy Agency, Vienna (Austria)); Steinhaeusler, F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European Congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Currently the government of the USA is being sued, directly or indirectly through its operating contractors, for alleged radiation-related injuries, with over 10 billion dollar at risk. Major accidents in the nuclear industry and the increasing emphasis on the indoor radon issue raise the specter of future claims for compensation of an unprecedented scale. The paper contains a review of the scientific basis for radiation-reduced risk in the context of recent developments in claims compensation within the American administrative and legal system, together with selected cases highlighting the issues raised. 14 refs., 6 figs.

30912 (OEVS-Mitteilung–1988, pp. 59-63) **Problems of regulating radiation exposure of the public.** Buldakov, L.A. (Ministry of Health, Institute of Biophysics (USSR)); Avetisov, G.M.; Barhudarov, R.M.; Golikov, V.Y.; Gusev, N.G.; Knizhnikov, V.A.; Pavlovsky, O.A. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The paper deals with approaches to regulation of population exposure. The largest contribution to the summed dose of population exposure from natural sources and medical examinations has been found out. Documents regulating exposure of the USSR population are analysed. Criteria for decision-making in the event of reactor accident are also discussed. 7 refs.

30913 (OEVS-Mitteilung–1988, pp. 162-166) **Assessment of the consequences of a research reactor credible accident release.** Kollas, J.G. (National Research Centre for the Physical Sciences Democritos, Athens (Greece)); Anoussis, J.N. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

An analysis of the consequences of a serious credible accident, a coolant flow blockage accident (CFBA) of the Greek research reactor (GRR) is presented. GRR, a 5 MW swimming pool type reactor, is located within Athens the largest population centre of Greece concentrating 32% of its population. To estimate the source term 31 isotopes are taken into consideration and conservative figures of fission product release are adopted. To estimate the CFBA consequences a CRAC2 consequence model version is used. Doses and individual cancer risk from exposure to the passing radioactive cloud are estimated up to a distance of 20km from the reactor site. Collective exposure and latent health effects due to initial exposure and chronic exposure from inhalation of resuspended radionuclides and exposure to groundshine from contaminated ground are estimated for the total Athens area of 3081000 inhabitants. The results of the analysis suggest that the CFBA consequences are not significant. 10 refs., 9 figs., 2 tabs.

30914 (OEVS-Mitteilung–1988, pp. 365-369) **Worldwide trends in occupational exposures at nuclear power plants.** Horan, J.R. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In 1984, a study of selected nuclear power plants in 7 countries, noted large differences in collective dose between countries and between similar plants. Variations of factors of 5-10 are quite common. Exposure experience is very site and country specific. On the average, occupational exposures are higher at nuclear power plants in the USA than in other industrialized countries. There is growing evidence that the number of operational improvements since the TMI-2 accident of 1979 have resulted in a downward trend in collective doses. There is a continuing need for programs of more timely and thorough radiation exposure management. 2 refs., 1 fig.

30915 (OEVS-Mitteilung–1988, pp. 449-464) **Dosis loads for temporary workers in decontamination and radiation protection engaged in West German nuclear power plants.** Bartels, R.; Neuburger, E.; Kappis, H.P. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In the annual inspections of German nuclear power plants a lot of work is done by external specialists, workers and unskilled workers.

Data of 1983-1986 have been collected in a decontamination company SInA GmbH Pforzheim. This company did at average 15 power plant inspections, and employed up to 350 coworkers. Decontamination and radiation monitoring are the most important activities. The doses show a continuous decrease over the years. Contrary to expectations the extremely high doses are found with experienced workers. 18 figs. (qui).

30916 (OEVS-Mitteilung–1988, pp. 630-634) **Neutron and gamma radiation doses topography around the rb reactor.** Antic, D. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)); Sokcic-Kostic, M.; Pesic, M.; Ninkovic, M. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

During the operation of the RB reactor the doses of neutron and gamma radiation are continually controlled and registered by measuring the dose rates in determined measuring points. The stationary dosimetry system of the reactor and transferable dosimetry instrumentation are used for these measurements. The mean neutron and gamma dose rates in measuring points (near the reactor, in reactor hall, in reactor building, in surroundings of reactor building, at the site of the institute) are analyzed. The results of measurements performed during last few years for various operation modes and power values of the reactor are given. The review of the stay of reactor staff in rooms of reactor building during various modes of reactor operation is given as result of this topography. 5 refs., 3 figs.

30917 (OEVS-Mitteilung–1988, pp. 712-728) **Chernobyl accident and its radiological impact for Austria.** Boeck, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna (Austria)); Buchtela, K.; Grass, F.; Hammer, H.; Tschirf, E.; Tschurlovits, M.; Unfried, E.; Hedrich, E. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

This paper comprises information on two quite different topics: the effects of the Chernobyl fallout to Austria such as contamination of food, plant, water and ingestion dose; safety comparison of the Chernobyl reactor with the reactor types used in the West, especially the BWR's. 5 refs., 8 figs., 9 tabs. (qui).

30918 (OEVS-Mitteilung–1988, pp. 846-854) **Activity concentration in the discharge of a sewage purification plant.** Dierkes, L. (Technischer Ueberwachungs-Verein Baden e.V., Mannheim (Germany, F.R.)); Schueckler, M.; Untucht, M. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Samples were taken, after the Chernobyl accident, of the discharge from a sewage clarification plant of Mannheim (FRG) and analyzed. Activity concentrations of Ru 103, Ru 106/Rh 106, Cs 134, Cs 137, Ce 144/Pr 144, Sb 125 and Ag 110 for about 100 days after the 01 05 1986 are given. Two models for this concentrations are formulated and the results of calculations are compared with the measured values. 3 figs., 1 tab. (qui).

30919 (PB–89-860472/XAB) **Chernobyl nuclear reactor accident fallout: measurement and consequences. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 73p. Available from NTISPC N01/MF N01.

This bibliography contains citations on the consequences of the radioactive fallout from the Chernobyl nuclear reactor accident. Transfrontier radioactive contamination, deposition of radioactive pollutants from the atmosphere, radionuclide concentrations in ground-level air and soil contamination, radionuclide concentrations in vegetation and food, monthly radioactive monitoring in different countries, possible health hazards caused by the radiation, and estimates of radiation doses to the population from the fallout are discussed. (Contains 116 citations fully indexed and including a title list.)

30920 (PSI–25) **Iodine severe accident behaviour code IMPAIR 2.** Furrer, M.; Cripps, R.C.; Frick, E. Paul Scherrer Inst. (PSI), Villigen (Switzerland). Jan 1989. 36p. Order Number DE89614403/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The iodine behavior code, IMPAIR 2, written in FORTRAN, is described. About thirty rate constants are used to formulate twenty differential equations. These equations model the behavior of various iodine species in a sump and the gas phase after a hypothetical core-melt accident. Apart from purely chemical equilibria, the phase transfer of aerosols, elemental iodine, organoiodine species and droplet carry over during pressure release are also described. (author) 17 refs., 3 figs., 6 tabs.

30921 (SAND–89-1194C) **Validation of core debris/concrete interactions and source term models.** Powers, D.A.; Bradley, D.R.; Brockmann, J.E.; Copus, E.R.; Greene, G.A.; Burson, S.B. Sandia National Labs., Albuquerque, NM (USA). 1989. 11p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-890546–6: Seminar on fission product transport processes in reactor accidents, Dubrovnik, Yugoslavia, 22-26 May 1989). Order Number DE89011882/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The need for improved models of core debris interactions with concrete has been met by several computer codes. In this paper, the status of validation of one of these codes, CORCON, will be discussed. The phenomenon that the CORCON code and the other core debris/concrete interactions codes attempt to model is the thermal attack on concrete by an internally heated, chemically reacting, molten mixture of metals (steel and unoxidized zirconium cladding) and oxides (UO_2 and ZrO_2, predominantly). Two key features of the models that must be validated if confidence is to be placed in the model predictions are the (1) heat transfer from core debris, and (2) heat generation especially that caused by chemical reactions. A third key feature, the release of radionuclides during core debris/concrete interactions, is not explicitly addressed in this paper. 23 refs., 6 figs.

30922 (SFB–151-7) **Vibration transmission behaviour of reinforced concrete components under extreme impact stresses.** Chouw, N.; Stangenberg, F. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 151 - Tragverhalten und Tragfaehigkeit von Baukonstruktionen unter Dynamischen Einwirkungen. Jul 1987. 72p. (In German). Available from Copy held by UB/TIB Hannover.

In order to examine the vibration transmission behaviour due to short, concentrated high impact loads (e.g. on impact of missiles), in the context of this research project, dynamic calculations were done on reinforced concrete plates and on a cylindrical reinforced concrete structure. To the fore is the passing on of the dynamic stresses to remote parts of the structure, where the components immediately subject to the impact load are designed so that the plastic limits of carrying capacity are largely used up. In comparison with experimental results, the suitability of the processes of calculation used for a sufficiently accurate description of the vibration processes, particularly for the post-vibration behaviour after the occurrence of the maximum deflection, is shown. It follows from the study that, compared to a linear/elastic calculation, the taking into account of non-linear material behaviour (such as crack formation in the concrete and plastification of the concrete and the reinforcement), which remains limited to areas of the supporting structure which can be defined, can reduce the size of the stresses induced in remote areas (acceleration etc.) considerably. (orig./RHM).

30923 (SSI–87-09) **What did they say? on radio and TV about Chernobyl and how did we experience the information?.**

Findahl, O.; Hanson, G.; Hoeijer, B.; Lindblad, I.B. National Inst. of Radiation Protection, Stockholm (Sweden). 10 Mar 1987. 220p. (In Swedish). Order Number DE89613825/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

This is a report on a research project concerning how the Swedish population did react to information from the Chernobyl incident provided by authorized responsible persons in radio and TV. The investigation consists of studies of reactions of individuals carried out by interviews and what was broadcasted on the two TV-channels and the three nation wide radio channels during a 40 days period beginning on 28 April 1986. (O.S.).

30924 (SSI–87-23) **Chernobyl - radioactivity in sludge produced in wastewater treatment plants.** Andersson, P. National Inst. of Radiation Protection, Stockholm (Sweden). 20 Aug 1987. 33p. (In Swedish). Order Number DE89613826/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report presents measurement, programmes and results from sludge samples taken from municipal wastewater treatment plants. The magnitude of the radiation doses occuring when sludge is spread on farmland is calculated. If sludge produced from May to December 1986 is spread on farmland in the same range as the foregoing year the collective dos from victnals would be about 1 manSv over a 50 years period. (L.F.).

30925 (SSI–87-31) **Medical consequences of a nuclear plant accident.** Olsson, S.E.; Reizenstein, P.; Stenke, L. National Inst. of Radiation Protection, Stockholm (Sweden). 13 Nov 1987. 59p. (In Swedish). Order Number DE89613862/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The report gives background information concerning radiation and the biological medical effects and damages caused by radiation. The report also discusses nuclear power plant accidents and efforts from the medical service in the case of a nuclear power plant accident. (L.F.).

30926 (WHC-SA–0204) **Fast Flux Test Facility Passive Safety flow transient test.** Harris, R.A.; Burke, T.M.; Padilla, A. Westinghouse Hanford Co., Richland, WA (USA). Mar 1988. 10p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-880506–28: American Nuclear Society topical meeting on the safety of next generation power reactors, Seattle, Washington, USA, 1-6 May 1988). Order Number DE89011856/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The data collected during a special flow decrease test conducted in the Fast Flux Test Facility (FFTF) as part of the Passive Safety test program have been evaluated, tabulated, and partially analyzed. The test consisted of a rapid, 9% decrease in flow rate with no control rod movements. It was intended as a small scale simulation of a loss-of-flow transient in a moderately sized liquid metal reactor. Accurate and low noise level power and flow indications were determined. Corrections to the power level neutron signals to account for coolant temperature changes were noticeable. A preliminary analysis using the SASSYS computer code is in essential agreement with the data; however, the results are quite sensitive to the assumptions made in the reactivity models. 7 refs., 8 figs., 1 tab.

25 ENERGY STORAGE

30927 (AIL–401U463) **Energy storage on the supply side or the demand side.** Codrington, J.B.; Smith, C. Acres Consulting Services Ltd., Niagara Falls, ON (Canada). 1986. 90p. (CE–02607). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Traditional large-scale supply side electrical energy storage methods are compared with demand side energy storage methods that may now be economic because of recent electric utility changes or because of recent development work. The characteristics of various energy storage methods are summarized. Promising options are identified: residential thermal energy storage for space heating, commercial thermal energy storage for comfort conditioning, and battery and thermochemical energy storage. Actions to expedite use of these options are proposed. Many Canadian utilities have a high proportion of hydroelectric generation and have the option of storing water at times of low demand; these utilities may not benefit from energy storage until their generation mix has become dominated by less flexible generation such as nuclear or coal-fired units. Energy storage on the demand side raises safety and quality of supply issues; these issues must be properly addressed to protect the interests of other customers and the safety of the employees of the utility. An annotated bibliography of 145 references and the results of a survey of Canadian utilities are included. 145 refs., 10 tabs.

2501 Magnetic

Refer also to citation(s) 31602

30928 **Demand-side load leveling battery storage at the Princeton Plasma Physics Laboratory.** Hurwitch, J.W. (Princeton Plasma Physics Lab., Princeton, NJ (US)); Huttar, D.E. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

The concept of demand-side battery storage as a means to level daily electricity loads and reduce electricity costs has been around since the late 1970's. By installing a battery storage system, the customer can store off-peak power and then use this stored power to cut peak demands. The reduced peak demand will result in significant savings to many industrial customers who pay significant demand charges as part of their electric rates. The Department of Energy (DOE) has undertaken an aggressive technology transfer program in an effort to use battery storage at DOE and other Federal installations. The Princeton Plasma Physics Laboratory (PPPL) was identified as a facility who could benefit significantly from a battery storage system. A feasibility study has recently been completed in which a thorough engineering and economic analysis was performed. An advisory committee was set up to ensure that the objectives of this project are met from the perspectives of interested participating organizations. The objectives of the project were determined to be: reduce electric billing to PPPL; energy conservation through improved electric system efficiency; demonstrate battery technology application; provide mechanism for hands-on study and evaluation of the principle and techniques; complement to EPRI/SCE supply side battery storage project; and provide peripheral operational benefits to PPPL. This paper highlights the results of the feasibility study.

2504 Capacitor Banks

Refer also to citation(s) 30818

2506 Thermal

Refer also to citation(s) 30764, 30967, 30987, 31068

30929 (ITL–8509, pp. 95-99) **Aquifer thermal energy storage systems with two aquifers.** Lau, K.C. (Strata Engineering Inc., Toronto, ON, Canada); Crawford, A.M.; Mirza, C. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Recently there has been an increased use of Aquifer Thermal Energy Storage (ATES) systems for the conservation of energy in large office buildings. Typically in ATES projects with one aquifer, the injection and production wells are located as far apart as possible, usually at the boundaries of the site. This is to reduce the possibility of thermal contamination. One possible solution to this potential problem, at sites where two independent aquifers co-exist, may be to use a central injection/production system such that hot

water is stored in one aquifer and the cold water in another. An example of such a site is at Scarborough, Ontario. In this paper the factors which affect the efficiency of both a one- and two-aquifer sytem is examined by means of a parametric study utilizing analytical procedures. 3 refs., 7 figs.

30930 (ITL–8509, pp. 90-94) **Comparison of long-term aquifer thermal energy storage experiments to 3-D computer simulations.** Kangas, M.T. (Helsinki Univ. of Tech., Espoo, Finland); Lund, P.D.; Laitinen, T. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A 3-dimensional, finite difference aquifer heat storage (ATES) simulation model and field experiments used in the validation of the model are described. The field experiments made continuously for 10 years show that energy recovery ratio of 74% can be obtained, even at high ground water flow rates, when the temperature of the stored water is relatively low (+23/sup 0/C). With 70/sup 0/C storage temperature, the recovery ratio is reduced to 55%. The results obtained with the simulation model developed in the study are compared with measurements. Some parameter sensitivity studies are also made with the simulation model. 4 refs., 4 figs., 1 tab.

30931 (ITL–8509, pp. 85-89) **Heat storage and heat pumps on aquifer. Two case studies.** Iris, P. (Ecole des Mines, Fontainebleau, France); Viennot, P.; Ausseur, J.Y.; Sauty, J.P. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Two pilot plants, working for some years, are presented in this paper. Both concern the same regional sandy aquifer located in the Parisian basin, at an average depth of 80 m, a temperature of 13/sup 0/C and an average flowrate per well of 60 m/sup 3//h; this aquifer represents a very interesting target for the urban area of Paris and its suburb. The first one, at Aulnay-sous-Bois (15 km east of Paris), deals with 224 apartments in a collective building heated by means of the heliogeothermal doublet which is based on the seasonal thermal recharge of the aquifer exploited during winter. This particular system is proposed to make possible a large thermal utilization of aquifers (with low natural velocity) in dense urban areas. The paper describes the system, the results of the first year of operation (1983-1984) and deals with economical aspects. The other one, operating since 1982 at Montreuil sous-Bois (in the suburbs of Paris), concerns space heating and cooling of 45,000 m/sup 2/of office buildings. It uses a pair of wells (doublet) with a warm storage and a cold storage. The warm storage, which collects the cooling wastes during summer, increases the thermal power of the cold source of the heat pumps in winter. On the other hand, the cold storage increases the cooling power of summer, by heat extraction (by the heat pumps) during winter. 3 refs., 2 tabs.

30932 (ITL–8509, pp. 80-84) **Aquifer heat storage technology in Sweden.** Hyden, H. (SWECO, Swedish Consulting Group, Stockholm, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and in French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Several low-temperature aquifer heat-storage projects are being implemented or are under design in Sweden. The heat storages are normally used for storing heat from warm surface water in the summer to be used as heat sources for heat pumps in the winter. The heat pumps in these projects are in the range 0.5-10 MW heat. Several methods for charging the heat are being tested. During the construction and operation of the storage facilities various potential technical problems are carefully evaluated. These primarily concern the thermal behaviour and efficiency of the storage facilities, well design, and water chemistry problems (deposits, corrosion, clogging). Environmental aspects of the various installations are also being evaluated. 4 figs., 1 tab.

30933 (ITL–8509, pp. 71-74) **Prototype of underground high-temperature heat storage in Thiverval-Grignon (France).** Housse, B.A. (Societe Nationale Elf-Aquitaine, Paris, France); Despois, J. Intertask Ltd., Ottawa, ON (Canada). 1985. (In French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communicationds Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In 1978 the Thiverval-Grignon site was selected for a demonstration project which would store the heat dissipated in the operation of a household garbage incineration plant and use the heat retrieved to supply the neighbouring municipality of Plaisier. Test drilling in 1980 led to selection of sand beds at 500 m for the demonstration project. The system includes a central storage, would have to include a central well (termed hot), for storage and storage retrieval from hot water, and peripheral wells (termed cold) arranged in a circle around the central well and alternately pumped out and filled in such a way as to form two loops with the central well; in addition, all wells would play a role in regulating the columes of superheated rocks. At storage phase injection temperatures of 180/sup 0/C, retrieval phase temperatures between 75/sup 0/C and 180/sup 0/C were obtained. The heat recovery was 20,000 MWh which represented a 60% yield. This prototype unit also required an intricate water treatment system for decarbonation and desilication, as well as special pump equipment of temperature connected to injection control and safety devices for the central well. The storage facility is planned to be operational by Apr-May 1986. 3 figs.

30934 (ITL–8509, pp. 68-70) **Low temperature thermal aquifer storage. A full scale experiment with the purpose of avoiding long term cooling of the subsurface environment.** Holm, T. (Chalmers Univ. of Technology, Goteborg, Sweden); Wilen, P. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications branch, 580 Booth St., Ontawa ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In Falkoeping in central Sweden, a two-well groundwater heat pump system was constructed in the beginning of 1985. The heat pump system is used for tapwater and heating of a communal house. The total heat pump capacity is 180 kW and the aquifer consists of a fractured sandstone formation at 30-60 m depth. The wells are separated by 85 m and have a capacity of 15 l/s each. As a pilot project of the area and to avoid long term cooling of the subsurface, a seasonal low temperature storage in the aquifer is planned for 1986. Hydrogeological data were used to predict the behaviour of the aquifer. Computer simulations have been done, as well as analytical calculations. The results show the general possibilities and limitations for this kind of system. 4 refs., 3 figs.

30935 (ITL–8509, pp. 65-67) **Brunkeberg aquifer thermal storage in central Stockholm.** Eriksson, A. (AIB Consulting Engineers, Solbna, Sweden); Johansson, S.; Abyhammar, T. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An installation for combined space heating and cooling utilizing heat storage in an aquifer is planned to start operation in 1986. The buildings, which include three city blocks in Stockholm, have a high space heating and cooling requirement. Some 1000 m/sup 3/of oil fuel can be saved annually by connecting the heating and cooling systems to a heat store with a capacity of 5000 MWh. The temperature of the heat store will vary between 25/sup 0/and 5/sup 0/C. 2 refs., 3 figs.

30936 (ITL–8509, pp. 58-64) **Investigation of the vertical flow aquifer thermal energy storage concept and numerical simulation of the Dorigny field experiment.** Doughty, C. (Lawrence Berkely Lab., Berkeley, CA, USA); Tsang, C.-F. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A mathematical modeling study of the vertical-flow aquifer thermal energy storage concept is made. A history match calcultion of the field experiment at Dorigny, Switzerland, is carried out using two simplified models. The main heat-loss mechanisms are isolated to study their relative importance. Finally, variations on the Dorigny experimental configuration are studied to examine the behavior of the vertical-flow storage system in general. 7 refs., 8 figs., 3 tabs.

30937 (ITL–8509, pp. 53-57) **Aquifer thermal energy storage experimental project in Italy.** Carotenuto, A.; Fucci, F.; La Fianza, G.; Reale, F.; Biggiero, V. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $n/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The preliminary work carried out for an aquifer thermal energy storage (ATES) experiment in Italy is presented. A general hydrogeological survey was employed in the Campania region and resulted in the selection of five sites. The proposed system involves a reverse-cycle machine which operates both as a heat pump and a refrigerator. Technical aspects are briefly discussed and schematics provided. 4 figs., 1 tab.

30938 (ITL–8509, pp. 48-52) **Experience with chilled water storage in a water table aquifer.** Brett, C.E. (Univ. of Alabama, Tuscaloosa, AL, USA); Schaetzle, W.J. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The University of Alabama is monitoring the aquifer air conditioning system at the University Recreation Center. The monitoring program defines the aquifer through analysis of core samples from fifteen monitoring wells; evaluates aquifer operation through temperature taken at regular intervals from over 100 data points and timely aquifer water heights taken at regular intervals; and evaluates system performance through measurements of thermal energy to and from the aquifer and of work into the system. The data is recovered through manual and computer acquired data. The data is analyzed to determine aquifer operation and performance and to determine system operating parameters. The system has been operating for over two years and has provided 100 percent of the air conditioning for the 1983 and 1984 summers. Energy savings to provide chilled water to the cooling coils is 40 to 50 percent of conventional chilling energy. 5 refs., 6 figs.

30939 (ITL–8509, pp. 43-47) **Potential for seasonal storage of industrial surplus heat.** Boldt, J. (Technical Univ. Of Denmark). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The practical possibilities for utilizing industrial surplus heat depend strongly on a match between the amounts of producer and consumer heat, its time variations, and the temperature levels. One way of improving this match and thereby the potential for utilizing the surplus heat is to use thermal energy storage. The paper addresses the problems surrounding the incorporation of thermal energy storage in district heating systems aimed at utilizing industrial surplus heat. It was found that 5-10 percent of the gross fuel consumption in industry might be utilized for district heating purposes. For 22 out of 88 industrial surplus heat sources, that have been investigated, seasonal thermal energy storage might be of interest. For the remaining part of the heat sources there is either no need for storage or the distance between heat supply and heat demand is too large. A seasonal thermal energy store may often not be utilized to its full capacity during significant periods of its lifetime. 5 refs., 9 figs., 1 tab.

30940 (ITL–8509, pp. 38-42) **Project of thermal storage in deep aquifer (Sarcelles, France). Technical data and economic analysis.** Boisdet, A. (Inst. Mixte de Recherches Geothermiques, Orleans, France); Menjoz, A. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada, K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An industrial aquifer thermal storage experiment at medium depth is planned at Sarcelles, in the Paris region, to be operational by 1986. The heat to be stored will be supplied by a household garbage incineration plant. The plant is equipped with an energy recovery system that is connected to the urban heating system of Sarcelles. The heat storage system consists of paired wells in the Neocomian stage, a clay-sand aquifer located at a depth of 900 metres. The maximum temperature of the stored water will be below 50/sup 0/C, and the maximum flow will be 150 m/sup 3//h, which represents a maximum immediate storage retrieval of 9 MW. The project as a whole was the subject or indepth studies from which were drawn up a series of precise technical specifiations. Economic aspects of the project are discussed. 3 refs., 2 figs., 2 tabs.

30941 (ITL–8509, pp. 33-37) **Permeability of Ironton-Galesville sandstone at elevated temperature and pressure.** Blair, S.C. (Lawrence Livermore Natonal Lab., Livermore, CA, USA). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto,

Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Research Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resouces Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A series of permeability tests have been conducted at elevated temperature and pressure on samples of Ironton-Galesville sandstone. These tests were in support of the Aquifer Thermal Energy Storage (ATES) site in St. Paul, Minnesota, operated by the Department of Energy. This paper reports permeability of core samples to two different fluids with time at temperatures of 25, 90, 125, and 150/sup 0/C. The results presented here indicate that on the time scale of days, the flow of heated groundwater, at flow rates equivalent to those in the near-well region, can cause extensive dissolution of cementing agents and loss of mechanical strength in the sandstone cores. The data also indicate that during heating of the core, permeability is reduced by pore throat blockage accompanying the liberation of fine particles. These results indicate that operation of the ATES facility at St. Paul may be changing the fabric of the host aquifer; however, results of short-term storage tests indicate there has been no significant impact on the hydrologic performance of the aquifer. 4 refs., 6 figs., 1 tab.

30942 (ITL–8509, pp. 25-32) **Seasonal heating and cooling through aquifer energy storage.** Arthurs, D.M. (James F. Hickling Consultants Ltd.); Chant, V.G.; Morofsky, E.L. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This study considers use of the aquifer as part of the Scarborough Government of Canada Building heating and cooling system. Four different strategies were modeled analytically on a monthly basis. Each strategy utilized different combinations of the following available components: heat pump, cooling tower, aquifer, and boiler. The strategies were evaluated based on both the energy input and annualized cost. It was found that storage of cooling energy made more sense than storage of heating energy for this application. The bulk of the heating could be accomplished by heat transfer within the building. The energy input necessary to meet the heating and cooling demand of the building was minimized through utilization of the aquifer for seasonal storage. However, the capital cost of the aquifer made its use less economical in this particular application than an alternative strategy which did not use an aquifer. 4 refs., 9 figs.

30943 (ITL–8509, pp. 20-24) **Impact of water quality on aquifer thermal energy storage.** Allen, R.D. (Pacific Northwest Lab., Richland, WA, USA). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Ground-water quality may affect the regional potential for aquifer thermal energy storage (ATES). Six mechanisms can impair reservoir permeability: particulate plugging, chemical precipitation, liquid-solid reactions, formation disggregation, oxidation reactions, and biological activity. Countermeasures to reduce these effects are identified. The chemistry of ground-water depends upon solution, precipitation, and fluid mixing. Modeling of water analyses indicated three problem reactions: precipitation of calcium carbonate at elevated temperature, solution of silica at elevated temperature, followed by its precipitation at lowered temperature; and oxidation and precipitation of iron compounds. Aquifers composed of quartz sands and sandstones are promising for low temperature and chilled water storage. Quartz-bearing rocks are promising for high temperature storage, if silica dissolution and precipitation is insignificant. Of the 19 U.S. hydrologic regions reviewed, 10 were identified as having characteristics necessary for ATES development. 12 refs.

30944 (ITL–8509, pp. 15-19) **The Danish aquifer thermalenergy storage program.** Qvale, B. (Technical Univ. of Denmark). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A short survey is given of the projects that constitute the Danish Aquifer Thermal Energy Storage program, together with a list of ten references. 10 refs.

30945 (ITL–8509, pp. 3-14) **Aquifer thermal energy storage in the United States.** Kannberg, L.D. (Underground Energy Storage Program, Pacific Northwest Lab., Richland, WA, USA). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Current United States Department of Energy funding of Aquifer Thermal Energy Storage (ATES) is concentrated on a high temperature (up to 150/sup 0/C) ATES field test on the St. Paul campus of the University of Minnesota. Four short-term test cycles and the first of two long-term test cycles have been completed at this site. Utilization of chill ATES to meet summer air conditioning demands has been monitored at two operating sites in Tuscaloosa, Alabama. The systems utilize a cooling tower to directly chill groundwater pumped from a water table aquifer for storage in the same aquifer. The first of the two systems has exhibited relatively poor performance. 2 figs., 2 tabs.

30946 (ITL–8509, pp. 75-79) **Short-term aquifer thermal energy storage (ATES) test cycles.** Hoyer, M.C. (Minnesota Geological Survey, St. Paul, MN, USA); Walton, M.; Kanivetsky, R.; Holm, T.R. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch,580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Four short-term field tests of the Aquifer Thermal Energy Storage (ATES) concept, using the Upper Cambrian Fanconia-Ironton-Galesville confined aquifer, were recently completed at the University of Minnesota, St. Paul campus. Approximately 1.2 x 10/sup 4/m/sup 3/of aquifer water were pumped from the source well, heated by about 66/sup 0/C in a heat exchanger, and returned to the aquifer through the storage well. After storage, the energy was recovered by pumping the stored water through a heat exchanger and returning it to the supply well. Experimental results indicated a 60% energy recovery after 10 days storage, and 46% after 90 days. Highest temperatures recorded in monitor wells 7 and 14 m from the storage well were equal to the average injected water temperature. Major-ion composition of the injected and recovered waters followed expected trends. In particular, silica increased and calcium decreased with increased temperature in the recovered water. The

calcium-magnesium bicarbonate ground water in the aquifer required a precipitator for scale control. 2 refs., 5 figs., 1 tab.

30947 (ITL–8509, pp. 172-189) **Review and findings of the Second EX-IEA Workshop on Solar Assisted Heatpumps Systems with Ground Coupled Storage.** Catan, M. (Brookhaven National Labs, New York, USA); Dalenback, J.; van Hattem, D. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The paper gives an overview of the Second Workshop on Solar Assisted Heatpumps with Ground Coupled Storage, held in Vienna in May 1985. Tables with the key parameters and results of the presented systems are included. The main conclusion of the workshop was that, to a certain extent, a consensus exists about the most promising lay-outs for such systems for certain applications and that the systems seem to be cost effective in a number of cases with special conditions. The workshop was sponsored by the Joint Research Centre of the Commission of the European Communities, the IEA Solar Heating and Cooling Program and the IEA Advanced Heatpump Program. The first workshop was held in Ispra in September 1982. 1 ref., 4 tabs.

30948 (ITL–8509, pp. 161-171) **Underground heat storage in France. Present stage development and future prospects.** Boileau, Y. (Agence Francaise pour la Maitrise de l'Energie, Paris, France); Ferrande, R.; Marie, J.-P. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for bulding heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Interest in long-term heat storage techniques started to develop in France during the past decade. Most non-traditional sources of heat energy, whether available year-round (incineration of waste, industrial waste, etc.) or seasonally (solar heat, heat rejected by air-conditioning systems in summer, etc.), rarely output their energy in phase with the heating requirements that they could potentially satisfy. For this reason, a significant research and exploratory development effort is underway to explore heat storage techniques aimed at a more rational and economical use of available energy. The Agence Francaise pour la Maitrise de l'Energie (French Agency for Energy Management) and various public organizations have completed a broad spectrum of studies and pilot projects in this area. Some key data on energy demand in France are first presented to set the stage for a brief overview of the above-mentioned work. 7 refs., 2 tabs.

30949 (ITL–8509, pp. 154-158) **Analysis of air-conditioning system with chilled-water storage in aquifer.** Baizhong, Z. (Northeast Univ. of Technology, Shenyang, China); Rongyi, Z. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper investigates the optimal performance of an air conditioning system with chilled water storage in an aquifer. The system consists of 4 subsystems: the general air conditioning system, the reheat system, the chilled water system, and the water cooling system. Equations are set up to analyze the subsystems. An objective in function, z, is employed to determine the optimal conditions of the system. Calculating methods are explained as they are applied to a practical project. 8 refs., 4 figs.

30950 (ITL–8509, pp. 149-153) **Heating of an office building using solar energy in combination with a heat pump and seasonal heat storage.** van der Bruggen, R.J.A. (Bredero Energy Systems B.V., Bunnik, The Netherlands); Snijders, A.L. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A large newly built office building (total floor area of approximately 10,000 m/sup 2/) is heated by a system consisting of 450 m/sup 2/low temperature, single glazed solar collectors, a gas driven heat pump and a seasonal heat storage system in an aquifer with a width of 30,000 m/sup 3/water. During the summer period, heat from the solar collectors (temperature level approximately 25/sup 0/C) and from the cooling equipment of the computer department (temperature level about 35/sup 0/C) is stored in the aquifer. During spring and autumn, the heat from the collectors and the cooling unit is used directly for space heating. To reach the temperature level necessary for space heating, a gas driven heat pump is applied. During the winter period, heat from the aquifer storage system is recovered for space heating by means of a heat pump. If necessary, additional heating is provided by a high efficiency gas boiler. The solar collectors are to be installed in March of 1985, so that during spring and early summer of 1985, the first experimental data will be available. Technical and economic aspects of the project are presented, as well as the results of a computer simulation of the model. 6 figs., 3 tabs.

30951 (ITL–8509, pp. 144-148) **A computer code for analyzing the performance of aquifer thermal energy storage systems.** Vail, L.W. (Pacific Northwest Lab., Richland, WA, USA); Kannberg, L.D.; Kincaid, C.T. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A code called Aquifer Thermal Energy Storage System Simulator (ATESSS) has been developed to analyze a user-friendly model designed to be run interactively on mini or personal comuputers. The model considers heat transport in the aquifer, overburden and basement formation, and surface heat exchanger performance. Additionally, stochastic generators for system inputs and outputs are available. ATESSS has been used to simulate the effect of different pumping/injection schedules on the system performance of several ATESSS systems including the St. Paul, Minnesota, field experiment. The results of these simulations show that the reliable yield of an ATESSS system can be influenced as much by operational policies as the aquifer's thermal properties. 4 refs., 5 figs.

30952 (ITL–8509, pp. 134-137) **Economical effect of the introduction of aquifer cold preservation for air-conditioning and temperature lowering of Shanghai Hongqido Airport.** Yung-Fu, S. (Geological Center of Shanghai, Economical Zone, Shanghai, People's Republic of China); He-yuan, S. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A

0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In view of the development of aquifer energy storage, this paper gives a systematic presentation of aquifer cold preservation contrived to air-condition the lounge of Shanghai Hong Qiao Airport. This contrivance, as compared with other refrigerators, has advantages such as economy of investment, low consumption of power and coal, low running cost, and convenience of management. Accordingly, aquifer energy storage has proven to be a good supply of cold and heat for the adjustment of temperature in buildings. This development further displays its beneficial economic effect in industrial production. 1 fig., 1 tab.

30953 (ITL–8509, pp. 129-133) **Groundwater heat pumps in combination with low-temperature natural heat sources. Economical and technical aspects.** Sorensen, S.N. (Technical Univ. of Denmark, Lyngby); Olsen, H.; Qvale, B. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The economics of the groundwater heat pump used for one- and two-family houses depend strongly on the cost of establishing the groundwater circuit system. Conventionally, such heat pumps extract water from an aquifer through one well and reinject it through a second at some distance. The establishment of these wells usually represents the costliest item in the installation budget. By using one well for both extraction and reinjection at different depths, the associated expenses for the drilling costs may be reduced considerably. In order to avoid thermal short circuiting, the system has to be regenerated. This may be done by using low-temperature solar heat, surface water from lakes or ocean, waste heat, or heat from the air. The presented economic analysis based on thermodynamic model simulations has shown that small two-family house single-well groundwater heat pump installations with low temperature (20-30/sup 0/C) aquifer heat storage can lower the total annual costs from 3 to 22% in comparison with common double-well plants when the injected heat is cost-free. These savings depend strongly on the temperature of the injected water. Neglecting the price for groundwater pumping the annual savings will be between 15 and 27%. Furthermore, a double-well test plant that has been established for general studies of the properties of groundwater heat pumps is described, and preliminary results presented. 4 refs., 8 figs.

30954 (ITL–8509, pp. 125-133) **The feasibility of seasonal storage of excess heat for the district heating system at Almere.** Snijders, A.L. (Heidemij Adviesbureau B.V., Arnhem, The Netherlands); van Woerkom, A.A.F. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The technical and economic feasibility of seasonal aquifer thermal energy storage of excess heat has been investigated. The excess heat will be produced in the summer period by a co-generation plant planned at the city of Almere. The plant will produce electricity for the national grid and will be a middle-load plant of about 52 MW. Both the heat produced during the winter and the stored heat will be used for the already existing district heating network. The amount of heat to be stored is about 187 TJ/year for the middle-load plant. The calculated storage efficiencies under equilibrium conditions are 81% and 75% respectively, if measures are taken to limit the effect of free convection. A storage temperature of 100/sup 0/C has an efficiency which is hardly higher than that of 90/sup 0/C. Realisation of the aquifer heat store requires an investment of about US$ 3.3 million, including the costs of a detailed geohydrological survey, engineering and supervision. 4 figs., 1 tab.

30955 (ITL–8509, pp. 121-124) **Research on energy storage in the underground water and its quality in Changzhou city.** Shen, G.-J. (Geological Bureau of Jiangsu Province, Nanjing, People's Republic of China); Tang, Y.-B.; Pang, B.-Q. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN.

Since 1980 a series of experiments has been made in the First Changzhou Cotton Mill (Jiangsu Province, the People's Republic of China,) for three winters. The purified waste water from the mill is chilled by ambient air temperature during winter and then injected into the main exploited horizons through two irrigating wells. The aquifers are composed of fine, medium and coarse sands. Their burial depths range from 71.6 m to 109.6 m. The low temperature water is retrieved for air conditioning in the summer. About 300,000 m/sup 3/of water at an average temperature of 12/sup 0/C was injected in 1980 to 1981. When exploited in summer, it had a temperature of 16 /sup 0/C, reducing the temperature of the original ground water by 4 /sup 0/C. This results in a usable refrigerating capacity of about 1860 kWh and saved 500 MWh of electricity. Also discussed is the necessity of well cleaning due to scaling, and the results of microbial studies on retrieved and original ground waters. 4 figs., 1 tab.

30956 (ITL–8509, pp. 115-120) **Design and implementation of a heated water injection experiment in an unconsolidated aquifer.** Palmer, C.D. (Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA); Blowes, D.W.; Frind, E.O. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

As part of a program to evaluate the use of unconfined aquifers for thermal energy storage (ATES), a hot water injection and storage experiment was conducted at Canadian Forces Base Borden in the fall of 1984. During this experiment 53.5 cubic meters of heated water were injected into a shallow, sandy aquifer at a rate of 0.0062 cubic meters per minute over a period of 6 days. The water, derived from the same aquifer, was pumped from a source well 60 meters west of the injection well. The water was heated to 36/sup 0/C and a bromide tracer was added as it was being pumped to the injection well. The injection well was 0.05 meter in diameter and has a 2 meter screen set at 5.3 meters below ground surface. Bundle-type peizometers were used to provide a cost-effective, three-dimensional monitoring network. Monitoring of the injected slug of heat continued for 135 days following the injection period to provide information about the storage phase of an ATES cycle. 8 refs., 7 figs.

30957 (ITL–8509, pp. 110-114) **Aquifer thermal energy storage experience with the Scarborough field trial.** Mirza, C. (Strata Engineering Corp., Toronto, ON, Canada); Lau, K.C.; Morofsky, E.L.; Crawford, A.M. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This paper describes the aquifer thermal energy storage(ATES) trial under development at a public building in Ontario, Canada. The geology of the site and the aquifer dynamics are described as well. A computer simulation determined that a perceived inhomogeneity of the aquifer would have no significant influence on the energy recovery factor of the system. 5 refs., 6 figs., 1 tab.

30958 (ITL–8509, pp. 105-109) **Project of thermal storage in deep aquifer (Sarcelles, France). Simulation of the hydraulic and thermal behaviour of the system.** Menjoz, A. (Inst. Mixte de Recherches Geothermiques, Orleans, France); Boisdet, A. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The aquifer thermal storage project under consideration in Sarcelles, north of Paris, involves a seasonal storage, paired-well 880 m and 940 m beneath the surface (Neocomian), which is to provide heat for a complex of approximately 920 housing units. The summer production system is a household waste disposal plant which produces known surpluses of recoverable energy which can be stored almost continuously for five months of the year. The forecasts based on theoretical simulations concern: the hydraulic and thermal behaviour of the reservoir as a function of the operational demand and geological inferences, the effect of the method of storage and recovery and the bases of the overall management model, integrating the coupling between the project's underground system and the existing surface system. This model is particularly useful for quantifying the energy gain that can be expected from the system, the effect of economic parameters and the project's overall financial viability. 3 refs., 8 figs., 1 tab.

30959 (ITL–8509, pp. 100-104) **Project for low-temperature storage of solar heat in Klippan, Sweden.** Lemmeke, L. (VBB/SWECO, Swedish Consulting Group, Malmoe, Sweden); Sundloef, B. Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for building heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $ N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In the town of Klippan in southern Sweden, a heat production plant with a heat pump of 2 MW, a heat storage of almost 1 million cubic meters and other facilities has been set up and put into operation. The system employs a method based on the use of solar heat as the heat source. During the summer, surface water is used as a solar collector and the heat collected is transferred to groundwater and stored in aquifers. The operation of the plant is monitored and registered by a supervision system, and in order to optimize the operation of the heat storage, the performance is simulated by means of a mathematical model. In this paper, the plant and the local conditions are described, the operational results accounted for, the construction and operational costs shown, and the performance of the heat storage illustrated. 1 ref., 5 figs.

30960 (NEI-DK–174) **Low-temperature heat storage at Risoe. Pilot project.** Schleisner Ibsen, L.; Kjaer Jensen, S. Risoe National Lab., Roskilde (Denmark). Nov 1987. 157p. (In Danish). Order Number DE89776152/JAW. Available from NTIS (US Sales Only), PC AA08;3.

EFP-80; EFP-81; EFP-82; EFP-84; EFP-85.

The project concerns low temperature energy storage in connection with the research reactor at Risoe National Laboratory, Denmark, and utilizes two wells. Surplus heat for storage is available as cooling water (40 deg. C) from the reactor and is used later in a heat pump. It is concluded that the establishment of low temperature aquifer storage at Risoe National Laboratory will be of interest because chalk (the aquifer material) has not previously been used for this purpose. It will also be of interest to discover whether precipitation can take place in chalk at a temperature lower than 40 deg. C and whether temperatures between 30 deg C - 40 deg. C will encourage bacteria growth. It is calculated that utilization of this system of heat storage could reduce annual reactor operational costs by 112 DKKr. (AB).

2509 Batteries

Refer also to citation(s) 31291

30961 (ANL–9012378) **ANL electrochemical program for DOE/EHP: Quarterly technical progress report for April through June 1988.** Argonne National Lab., IL (USA). Nov 1988. 21p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. Order Number DE89012378/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Argonne National Laboratory (ANL) Electrochemical Program for DOE/EHP carries out research, development, and evaluation directed toward improved electrochemical systems for future application in electric and hybrid vehicles. The program is one of the activities of the DOE Division of Electric and Hybrid Propulsion (DOE/EHP) and is conducted by the Electrochemical Technology Center at ANL. The goal of the DOE/EHP R&D activity is to increase to the greatest possible degree the national petroleum savings potential of electric and hybrid vehicles as a transportation alternative by developing the advanced technology needed to ensure widespread use. The objective of the ANL Electrochemical R&D Program for DOE/EHP is to contribute to this overall DOE goal by developing the improved electrochemical systems needed by these vehicles. The ANL Electrochemical Program for DOE/EHP includes advanced lithium/sulfide battery R&D, fuel cell propulsion system R&D, battery technology analyses and modeling, lead-acid battery R&D, nickel/iron battery R&D, and test evaluation of cells, modules, and batteries. This progress report covers the period of April 1, 1988 through June 30, 1988. 3 tabs.

30962 (PB–89-860548/XAB) **Magnesium batteries. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 55p. Available from NTISPC N01/MF N01.

Supersedes PB–87-866075.

This bibliography contains citations concerning magnesium battery development, performance, and electrochemistry. Magnesium alloy electrolytes are discussed in depth. Seawater, solar, and thermal batteries are discussed. (This updated bibliography contains 107 citations, 29 of which are new entries to the previous edition.)

30963 Reliability of LI/SO/sub 2/cells for long life applications. Levy, S.C. (Exploratory Batteries Div., Sandia National Lab., Albuquerque, NM (US)). v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

To satisfy the need for a battery to operate continuously for a period of up to five years with a high degree of reliability, Sandia National Laboratories has been working on a program to evaluate reliability of commercial batteries/cells. Initial energy and volume requirements dictated the use of a lithium chemistry. At the time, Li/SO/sub 2/was the only system commercially available. Cells were purchased from three domestic manufacturers and placed on a real-time test, predicted to last six years for cells with 100% efficiency. As cells began to fail, they were pulled from the test and subjected to a postmortem analysis. Several modes of failure were discovered, including glass-to-metal seal corrosion, positive pin (tantalum) corrosion, anode lead corrosion, and stress-corrosion cracking of the steel cans. The results of the real-time tests and reliability analyses are discussed. Also, the impact of the various material and design changes on long-term performance and reliability have been evaluated.

30964 Optimization of battery characteristics for urban electric van applications. Marr, W.W. (Argonne National Lab., Argonne, IL (US)); Walsh, W.J.; Miller, J.F. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

Batteries used in electric vehicles have many design variables that can be adjusted, often at the expense of the others, to reach an optimal design configuration for a given application. For instance, it is possible to sacrifice battery specific energy for the sake of increased battery peak power capability, and vice versa. Another possible trade-off is between battery cycle life and depth of discharge. This trade-off can be an important consideration with respect to replacement costs for certain batteries. For a specific vehicle design and operational requirements, there exits a unique set of battery characteristics among the trade-offs permitted that is best suited to the intended mission. Analysis has been performed for a state-of-the-art lead acid battery for an electric van application. A microcomputer software package, MARVEL, was used in the analysis. MARVEL is a user-friendly, interactive computational system which includes many recent modeling advances and improved understanding of battery and vehicle systems. It was developed for a battery/heat engine/hybrid vehicle system and can be used to analyze a pure electric vehicle, a pure heat engine vehicle, or a hybrid vehicle that employs batteries as well as a heat engine. Battery design is optimized for specific applications within the range of practical limits corresponding to its maximum specific energy and specific power capabilities.

30965 Recent developments in advanced lead-acid batteries for electric vehicle propulsion. Patil, P.G. (US Dept. of Energy, Washington, DC (US)); Miller, J.F. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

The U.S Department of Energy (DOE) has supported the research and development of advanced lead-acid batteries for electric vehicle applications. Since the initiation of the DOE Program, lead-acid batteries have been greatly improved and development efforts are continuing on advanced versions of lead-acid batteries. These include improved maintenance-free gelled-electrolyte technology, advanced tubular-plate designs, and an advanced flow-through battery concept.

30966 Evaluation of advanced lead-acid batteries developed for load-leveling applications. Miller, J.F. (Chemical Technology Div., Argonne National Lab., Argonne, IL (US)); Mulcahey, T.P. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

Argonne National Laboratory (ANL) has conducted an extensive evaluation of an advanced lead-acid battery developed for load-leveling applications. The battery technology was developed by the Exide Corporation under a DOE-sponsored cost-shared R and D contract with ANL during 1979-1982. The objective of that program was to increase battery life from 2000 to 4000 deep discharge cycles while maintaining or reducing initial battery cost. Full-size, 3100-Ah cells were fabricated by Exide and assembled into three one 6-cell and two 3-cell batteries. These 18-kWh and 36-kWh batteries were delivered to ANL's National Battery Test Laboratory in April 1982 for testing and evaluation. Design features, physical characteristics, and results of performance tests were previously reported. Southern California Edison is currently installing a 10-MW, 40-MWh load-leveling facility comprised of batteries based on this design.

30967 Flow batteries. McBreen, J. (Dept. of Applied Science, Brookhaven National Lab., Upton, NY (US)). v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

Several more promising batteries for load leveling and renewable power applications can be classified as flow batteries. All are electrochemical reactors with circulating electrolyte, and at least one of the reactants is stored externally to the cell stacks. It is also possible to periodically remove all reactants from the cells, and thus avoid the cumulative degradation processes that occur in batteries where the cell and reactant storage are coupled. Flow batteries are attractive because of the low cost of the reactants. The reactants are compatible with cell stacks that can be easily mass produced from extruded plastic and plastic carbon composites. Scale-up is relatively easy and the circulating electrolyte simplifies thermal management in large systems. At present, there are four flow batteries under development. These are: the zinc/bromine; zinc/chlorine; zinc/ferrilcyanide; and the chromium/iron redox system.

30968 Influence of electrolyte density on response of LiCl. Morosin, B. (Sandia National Labs., Albuquerque, NM (US)); Graham, R.A.; Bush, D.M. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

Recently, the authors reported that galvanic cells containing solid electrolyte in the form of porous compacts could be initiated into a persistent electrochemical response mode with controlled high pressure shock loading such as is produced by the detonation of high explosives. Study of the responses of such galvanic cells provides an opportunity to explore new aspects of shock-induced solid state chemistry, including determination of Gibbs' potentials of electrochemical reactions at high pressure and shock-induced melting. These galvanic cells also provide a new power supply concept similar to thermal batteries but with response times of microseconds rather than the more usual seconds. The authors have now carried out a series of electrochemical response measurements on a eutectic LiCl:KCl electrolyte with an MgO binder in a cell with a Li(Si) anode and a cathode composed of a mixture of FeS/sub 2/, the electrolyte and a SiO/sub 2/binder. In this configuration the open circuit voltage is closed to the theoretical value of 2.5 volts. High explosive, shock-compression loading was carried out in a standardized system which subjects the cell to a reproducible, quantifiable, pressure pulse whose amplitude is not strongly influenced by the density of the powder compact electrolyte. The rapid compression of the powder by the shock pulse causes a simultaneous increase in temperature whose magnitude is controlled by the density of the powder compact. Because of the additional pressure-volume work, lower density compacts achieve higher temperatures.

30969 Beta alumina failures in sodium/sulfur batteries. Beauchamp, E.K. (Sandia National Lab., Albuquerque, NM (US)). v.v of Fractography of glasses and ceramics. Frechette, V.D.; Varner, J.R. American Ceramic Society Inc., Westerville, OK (1988). (CONF-8608230–: Fractography of glasses and ceramics, Alfred, New York, USA, 3-6 Aug 1986).

Fractographic examination of beta alumina electrolyte tubes which failed during cell operation has resulted in the identification of two modes of tube failure in which the failure stress was produced by the cell cathode. One of these failure modes apparently involved generation of high tensile stress at the periphery of the cathode/electrolyte contact zone by differential contraction during cooling. The other failure mode involved a collapse of the tube wall with features having the general character of those produced by impact. It was concluded that local solidification and expansion of the cathode was responsible. Generally, the origins of the fractures were voids with diameters of 50 to 300 μm, often in combination with large (50 to 250 μm) beta alumina grains.

29 ENERGY PLANNING AND POLICY

Refer also to citation(s) 30676

2901 Energy Analysis and Modeling

Refer also to citation(s) 30819

30970 (ANL/EES-TM–371) **User guide for the Data Analysis, Retrieval, and Tabulation System (DARTS): A mainframe computer code for generating cross-tabulation reports.** Anderson, J.L. Argonne National Lab., IL (USA). Energy and Environmental Systems Div. Dec 1988. 36p. Sponsored by DOE Management & Administration. DOE Contract W-31109-ENG-38. Order Number DE89012930/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A computer system known as the Data Analysis, Retrieval, and Tabulation System (DARTS) was developed by the Energy and Environmental Systems Division at Argonne National Laboratory to generate tables of descriptive statistics derived from analyses of housing and energy data sources. Through a simple input command, the user can request the preparation of a hierarchical table based on any combination of several hundred of the most commonly analyzed variables. The system was written in the Statistical Analysis System (SAS) language and designed for use on a large-scale IBM mainframe computer. 3 tabs.

30971 (LBL–26585) **Energy Analysis Program: Annual report, FY 1988.** Cairns, E.J.; Levine, M. Lawrence Berkeley Lab., CA (USA). Mar 1989. 37p. Sponsored by DOE Conservation & Renewable Energy. DCE Contract AC03-76SF00098. Order Number DE89012737/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Energy Analysis Program continues to be involved in wide range of topics relating to the energy system of the United States and numerous other countries. Our interest in energy use and conservation in buildings has remained high, with increasing attention being devoted to studies of commercial buildings. The appliance standards continues to be the leading energy policy analysis activity of the Program. A long-term commitment to characterizing and understanding measured data of energy use in buildings continues. Interest in electric utility issues, with particular emphasis on demand-side activities and programs, continues high. New interest in competition among electricity generation options for utilities complements the demand-side analyses. This paper contains reports including: building energy analysis; energy conservation policy; and environmental policy analysis.

2902 Economics and Sociology

Refer also to citation(s) 30306, 30928, 30988, 30993, 30998, 31006, 31008, 31009, 31010, 31011, 31012, 31013, 31014, 31015, 31016, 31017, 31018, 31020, 31021, 31022, 31023, 31024, 31025, 31026, 31028, 31030, 31032, 31033, 31035, 31049, 31053

30972 (EO–M27-89) **Energy and Canadians into the 21st century. A report of the energy options process.** Energy Options, Ottawa, ON (Canada). 1988. 407p. (In English and French). (MICROLOG–89-01144). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Energy Options was designed to review and assess Canada's energy prospects and options into the 21st century by identifying and examining the elements of and relationships expected to play a critical role in shaping these prospects in the 1990s; by soliciting, encouraging, and facilitating input, comment, opinion, and advice from a wide range of associations and individuals; and by reporting on the technical and policy options and assessing these options. Seven conferences and seminars were held, and research was commissioned. This report presents the results of these consultations, covering current and long-term issues, the energy policy framework, energy development, security, the environment, markets, the fiscal system, efficiency, and technology. Comments and dissents are also included, as well as a list of participants and submissions, and the process (workshops and seminars) involved. 11 figs., 1 tab.

30973 (OH/EF–245) **Short-term economic outlook. Annual review.** Tharp, W.H.; Crawford, E.P.; Zerek, A.T.; Spiro, P.S.; Angastiniotis, M.; Parker, J.C.; Hachey, L.T. Ontario Hydro, Toronto, ON (Canada). Economics and Forecast Div. 1988. 55p. (MICROLOG–89-01320). Available from Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This annual review of the short-term economic outlook from the perspective of Ontario Hydro presents growth forecast tables for Ontario, Canada, the United States, Western Europe, and Japan. Energy markets and prices, economic indicators in Ontario and the U.S., and trends in the Canadian dollar and interest rates are also reviewed. 10 figs., 20 tabs.

30974 (OH/EF–256) **Prediction ranges. Annual review.** Parker, J.C.; Tharp, W.H.; Spiro, P.S.; Keng, K.; Angastiniotis, M.; Hachey, L.T. Ontario Hydro, Toronto, ON (Canada). Economics and Forecast Div. 1988. 26p. (MICROLOG–89-01319). Available from Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Prediction ranges equip the planner with one more tool for improved assessment of the outcome of a course of action. One of their major uses is in financial evaluations, where corporate policy requires the performance of uncertainty analysis for large projects. This report gives an overview of the uses of prediction ranges, with examples; and risks and uncertainties in growth, inflation, and interest and exchange rates. Prediction ranges and standard deviations of 80% and 50% probability are given for various economic indicators in Ontario, Canada, and the USA, as well as for foreign exchange rates and Ontario Hydro interest rates. An explanatory note on probability is also included. 23 tabs.

30975 (OH/EF–281) **Long-term economic outlook. Annual review.** Ontario Hydro, Toronto, ON (Canada). Economics and Forecast Div. 1988. 74p. (MICROLOG–89-01318). Available from Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This review provides economic growth forecast tables for Ontario, Canada, the US, Western Europe, and Japan. Economic growth, government policy, the long-term prospects for inflation, interest rates and foreign exchange rates, trends in the Canadian dollar, and energy markets and prices are also reviewed. Data generally cover 1965-2025. Appendices give a summary of historical and forecast data. 18 figs., 16 tabs.

30976 (OH/EF–1988) **Alternative scenarios for corporate planning.** Ontario Hydro, Toronto, ON (Canada). Economics and Forecast Div. 1988. 35p. (MICROLOG–89-01301). Available from Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The possibly wide divergences in economic performance of an economy are of particular importance in forecasting generation capacity in an electric utility, since this planning must be done over a very long time horizon. To take these divergences into account, conditional forecasts are prepared in the form of multiple scenarios. Four such scenarios have been prepared for the Canadian economy: a higher-productivity scenario, a most likely scenario, a deflation scenario, and a higher inflation scenario. Three alternative scenarios are given for energy markets and prices. Tables are presented showing various forecasts of economic indicators for Ontario, Canada, and the USA; energy prices; foreign exchange; interest rates relevant to Ontario Hydro; and cost indices. 3 figs., 10 tabs.

30977 (QER–E-21) **Energy: driving force of economic development.** Quebec Ministere de l'Energie et des Resources, Quebec, PQ (Canada). [1989]. 122p. (MICROLOG–89-01899). Available from Ministere de l'energie et des ressources, Direction des Communications, 200, chemin Ste-Foy, 7e etage, Quebec, PQ, Canada G1R 4X7; $N/C.

This document sets forth Quebec's energy policy for the 1990s, the direction it must take, and the objectives to be attained. A review of the energy sector in the province as it currently exists sets the stage for 9 statement of the objectives and opportunities. The

main energy resources (electricity, natural gas, oil, and petrochemicals) are then considered separately. The need for energy efficiency and diversity, research and technological development, consideration for the environment, cooperation between the public and private sectors, and government involvement are considered. 23 figs.

2903 Environment, Health, and Safety

Refer also to citation(s) 30529, 30805, 30903, 31001, 31102, 31126, 31167, 31474, 31988, 31989, 32410

30978 (EC–1988) **The changing atmosphere. Implications for global security. Conference statement.** Environment Canada, Ottawa, ON (Canada). 1988. 38p. (In English and French). (MICROLOG–89-01175). Available from Atmospheric Environment Service, Climatological Services Division, Terrasses de la Chaudiere, 10 Wellington St., Hull, PQ, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An international conference was held to consider the threats posed by the changing global atmosphere and how they might be addressed. This document presents a summary of the issues raised and the recommendations made for government policies. The major problems were considered to be: climate warming, rising sea levels and other phenomena induced by the greenhouse effect; depletion of the ozone layer; and long-range transport of toxic chemicals and acidification. The need was stressed for an action plan for atmospheric protection, which would include an international framework convention and would encourage other standard-setting agreements and national legislation in the relevant areas. Recommendations by the conference's working groups are listed under areas including energy, food security, urbanization, water and land resources, and industry.

30979 (PB–89-165443/XAB) **Annual report on abandoned or uncontrolled hazardous-waste disposal sites and Hazardous Waste Remedial Fund, 1988.** Iowa Dept. of Natural Resources, Des Moines, IA (USA). 1 Jan 1989. 154p. Available from NTIS, PC A08/MF A01.

Section 455B.425 of the Code of Iowa requires the Director of the Department of Natural Resources to give a full account to the Legislature and the Governor each January 1st regarding the Hazardous Waste Remedial Fund. Section 455B.427 of the Code of Iowa requires the Director of the Department of Natural Resources to transmit a report to the Legislature and the Governor each January 1st regarding those sites listed on the Registry of Abandoned or Uncontrolled Disposal Sites. The report is intended to fulfill both of these obligations.

30980 (PB–89-167506/XAB) **Toxic chemical release inventory magnetic media submission instructions. Section 313 of the emergency planning and community right-to-know act (revision).** ICF, Inc., Fairfax, VA (USA). Jan 1989. 25p. Available from NTIS, PC A03/MF A01.

This document provides basic specifications for the use of magnetic media to submit EPA Form R reports required by Section 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986), Public Law 99-499. The specifications and requirements presented in the document supplement to the reporting requirements presented in the Section 313 final rule (40 CFR Part 372). Submission of magnetic-media reports does not relieve the submitter from any of the regulatory requirements of the Section 313 final rule.

30981 (PB–89-859813/XAB) **Hazardous-materials transportation. January 1977-April 1989 (Citations from the NTIS data base). Report for January 1977-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 151p. Available from NTISPC N01/MF N01.

Supersedes PB–88-862412.

This bibliography contains citations concerning the transport of hazardous materials primarily by road, rail, and cargo vessel. Risk assessment, accident analyses, response programs, and explosives-container design aspects are among the topics discussed. Federal legislative aspects and state programs, and test procedures for a variety of containers are also considered. Selected fossil fuels, explosives, and hazardous chemicals are among the materials presented. Citations pertaining specifically to radioactive materials are discussed in a separate bibliography. (This updated bibliography contains 255 citations, 16 of which are new entries to the previous edition.)

30982 (PB–89-860340/XAB) **Packaging-materials biodegradation. January 1973-April 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 65p. Available from NTISPC N01/MF N01.

Supersedes PB–88-863295.

This bibliography contains citations concerning the biodegradation of packaging materials. Plastic films, cellophane, and biodegradable plastic bottles are emphasized. European, state, and local laws and regulations prohibiting the use of plastics that are not degradable are discussed. A starch-based plastic additive that promotes plastic biodegradation is briefly studied. (This updated bibliography contains 117 citations, 34 of which are new entries to the previous edition.)

30983 (SAND–89-8228) **Guide for preparing Safe Operating Procedures (SOPs).** Butler, D.M. Sandia National Labs., Livermore, CA (USA). May 1989. 44p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DR00789. Order Number DE89012814/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This Guide is intended to define Safe Operating Procedures (SOPs), outline the operations requiring SOPs, provide instructions for preparing SOPs, and document the approval and review procedures. A sample format is included.

2904 Natural Resources

Refer also to citation(s) 32075

30984 (PB–89-160998/XAB) **Fuel wood and charcoal research in the dominican republic. Results of the wood fuel development program.** Knudson, D.M.; Chaney, W.R.; Reynoso, F.A. Instituto Superior de Agricultura, Santo Domingo (Dominican Republic). 1988. 184p. Available from NTIS, PC A09/MF A01.

Color illustrations reproduced in black and white.

The Dominican Republic has the physical and biological requisites to be a net exporter of wood products. Instead, it now imports virtually all of its manufactured wood and faces serious shortages of fuel wood and charcoal. Wood-based products are the Dominican Republic's third most costly industrial and agricultural import. Other serious national and international costs are those derived from the deforested watersheds of this mountainous nation: eroded soil, silted-in reservoirs, irregular water flow in rivers and irrigation canals, nonfunctional hydroelectric plants, as well as businesses and families that must spend increasing amounts of their time or income to attain adequate fuel. The remarkable tree growth rates documented in this report suggest that the Dominican Republic has the potential to become self-sufficient in many essential forest products and to eventually develop forest industries to serve new internal and foreign markets.

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 30278, 30324, 30325, 30326, 30366, 30367, 30702, 30703, 30785, 30928, 30932, 30933, 30934, 30937, 30939, 30940, 30942, 30944, 30945, 30947, 30948, 30957, 30958, 31001, 31042, 31045, 31054, 31320, 31935, 31937, 31997

30985 (BNL–42334) **Brookhaven National Laboratory technology transfer five year plan fiscal years 1990-1994.** Brookhaven National Lab., Upton, NY (USA). 1989. 16p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89012554/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The program is conducted by the Office of Research and Technology Applications which endeavors to: 1. Promote and facilitate the fullest range of technical cooperation between Brookhaven and America's large and small business, academia, State and local governments and Federal agencies; 2. Stimulate acceptance by the US

private and public sectors of the Laboratory as a source of useful technology; 3. Collaborate with local, State and regional organizations that promote technical cooperation; 4. Improve the effectiveness of individual and organizational efforts in technology transfer through assistance, training, recognition and awards; 5. Develop a laboratory program of technology transfer that includes programmatic and spinoff technologies and is consistent with the Laboratory culture; and 6. Act as a clearing house for technical assistance requests made directly to the laboratory and forwarded by other Federal laboratories.

30986 (BNL–52165) **Brookhaven Highlights, October 1, 1987–September 30, 1988.** Rowe, M.S.; Cohen, A.; Seubert, L.; Horner Kuper, J.B. (eds.). Brookhaven National Lab., Upton, NY (USA). 1988. 98p. Sponsored by DOE/ER;DOE/NE. DOE Contract AC02-76CH00016. Order Number DE89012793/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report highlights Brookhaven National Laboratory's research activities for fiscal year 1988. Research programs range from physics and chemistry to medical and biology. (JF)

30987 (ITL–8509, pp. 190) **Thermal energy storage programme in Sweden.** Lundin, S.-E. (Swedish Council for Building Research, Stockholm, Sweden). Intertask Ltd., Ottawa, ON (Canada). 1985. (In English and French). (CONF-850905–: ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985;MICROLOG–89-00267). In *Enerstock 85. 3rd International conference on energy storage for buiding heating and cooling. Proceedings.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A oG1; $10 CAN.

This paper is an overview of research and development of thermal energy storage technology in Sweden. Heat storage can utilize the energy from seasonal energy sources such as solar heat, waste heat and natural heat (air, water). Short-term stores are more useful in direct heat production for peak shaving in plants using solid fuels, co-generation and refuse-burning. The role of storage is a system question which also has to consider the municipal energy situation, consumers' heating demand, existing production equipment and competing technologies such as oil and electricity. Seasonal storage of heat seems to have the most favorable conditions in the ground and directly in the geological deposits of soil and rock. Work carried out in the field of subsurface storage has, since 1979, resulted in the construction of a large number of research and pilot-plants in order to test the following techniques in full scale: storage in water (rock-caverns, pits, mines), storage in ground (boreholes in rock, tubes in clay and peat), and storage in aquifers (ground water in soil and rock). 2 refs., 3 figs., 1 tab.

30988 (LA–11561-MS) **The future of Chinese science.** Mason, C.F.V. Los Alamos National Lab., NM (USA). Apr 1989. 20p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89012798/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

China is attempting to emerge from its Third World status and become a modern technological state. The development of science and technology (S and T) plays a crucial role in this effort. The intelligentsia, profoundly maligned during the Cultural Revolution, is enjoying a resurgence in status, and S and T policies are set at the highest government levels. Recent reforms regarding commercial and entrepreneurial activities, budgets, and management practices reflect the Chinese resolve to improve their S and T capabilities. Ultimately, China will become a modern technological state; however, significant problems remain to be overcome: too few well-trained scientists, a preoccupation with immediate economic benefit of S and T endeavors, inadequate education and research funding levels, poor scientific equipment, and the lack of a modern communications infrastructure. 4 figs.

30989 (RISO-M–2774) **Impressions of the Japanese Sunshine and Moonlight projects.** Poulsen, F.W. Risoe National Lab., Roskilde (Denmark). Feb 1989. 28p. Order Number DE89776149/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

This travel report describes the 3-week tour for EC-researchers to Japan concerning the "Alternative Energy Programme" under the Sunshine and Moonlight projects. The tour covered the period November 21st to December 7th, 1988. Chapter 1 deals with similarities and differences in the energy situation in Denmark and Japan. Chapter 2 is a detailed, though qualitative, account of 11 visits to Japanese industries and research institutions in the alternative energy sector. Chapter 3 discusses interaction between known and future technologies. Fuel cells are treated in more detail. Chapter 5 is a qualitative summary.

30990 (UCRL–53689-88) **Institutional research and development, FY 1988.** Lawrence Livermore National Lab., CA (USA). 1988. 239p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012801/JAW. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

The Laboratory's Institutional Research and Development (IR and D) Program was established in 1984 to foster exploratory work to advance science and technology, disciplinary research to develop innovative solutions to support our national defense and energy missions. In FY 1988, the IR and D Program was funded by a 2% assessment on the Laboratory's operating budget. Our policy is to use these funds for researching innovative ideas in LLNL's areas of expertise and for developing new areas of expertise that we perceive to be in the national interest. The technical and scientific accomplishments of each project and of each institute funded this year are presented in this report. The projects were selected because they are expected to advance research in important areas that are too basic or too time consuming to be funded by the developmental programs or because they are somewhat risky projects that have the promise of high payoff. We are continually reappraising the IR and D Program. In particular, we seek new candidates for the Director's Initiatives, and we constantly reassess the work in progress. Each year, we make adjustments to further the Laboratory's policy of using the IR and D Program to fund innovative ideas with high potential for enhancing programmatic activities of national importance.

2906 Nuclear Energy

Refer also to citation(s) 30461, 30529, 30605, 30606, 30853, 30855, 30907, 30923

30991 (INIS-mf–11442) **Nuclear power and the nuclear fuel cycle. A quarterly review of overseas events.** Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Jun 1988. 5p. Order Number DE89617452/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The percentage of electricity generated by nuclear energy in each of the 26 countries that operated nuclear power plants in 1987 is given. The current policy and programs of some of these countries is described. News concerning uranium mining, enrichment, reprocessing and waste management is also included. Data in the form of a generalized status summary for all power reactors (> 30 MWEN) prepared from the nuclear power reactor data files of ANSTO is shown.

30992 (OEVS-Mitteilung–1988, pp. 291-295) **Uncertainties of risk assessment and public attitude study on nuclear energy based on fuzzy measure and fuzzy integral model.** Nishiwaki, Y. (International Atomic Energy Agency, Vienna (Austria). Div. of Nuclear Safety); Kawai, H.; Morishima, H. and others. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Uncertainties of risk assessment and a public attitude study on nuclear energy are discussed based on fuzzy measure and fuzzy integral model. Some examples of fuzzy optimization introduced in radiation protection in Japan are also discussed. 7 refs.

2907 Transport and Storage

Refer also to citation(s) 30927

2908 Waste Heat Utilization

Refer also to citation(s) 30995, 31029, 31049, 31150

2910 Conservation

Refer also to citation(s) 30971, 31001, 31067, 31075, 31099, 31100, 31101, 31103, 31104, 31105, 31163

30993 (PB–89-159107/XAB) **Report of the Office of Energy. Project evaluation and implementation.** RCG/Hagler, Bailly, Inc., Washington, DC (USA). Apr 1988. 65p. (HBC-REF–88-4261). Available from NTIS, PC A04/MF A01.

The purpose of the manual is to provide plant engineers with practical guidelines for the identification of opportunities for capital investments to improve energy efficiency, for the evaluation of these potential projects to check their economic attractiveness, and for the implementation of those projects that meet management criteria and are thus approved. The manual is divided into three sections: Project identification, Project evaluation, and Project implementation.

30994 (PB–89-165435/XAB) **Energy-management financing for state facilities and public schools.** Iowa Dept. of Natural Resources, Des Moines, IA (USA). Dec 1988. 54p. Available from NTIS, PC A04/MF A01.

The Department of Natural Resources (DNR) has committed to facilitate comprehensive energy management for state facilities, schools, hospitals, local governments, and other nonprofit organizations. The goal is to install all cost effective improvements, those with an aggregate payback of 6 years or less, by using private sector financing. To meet this goal, several programs were developed under Iowa's Building Energy Management Program. The DNR established a nonprofit corporation, the State of Iowa Facilities Improvement Corporation. The corporation finances, installs, and leases improvements to state agencies. The savings from improvements are used to make the lease payment. The Iowa School Energy Bank was established to serve Iowa public schools and community colleges. Six-month interest-free loans are offered to the schools for engineering analyses. Lease financing is offered for improvements under a master lease agreement with a regional bank at a group municipal financing rate. The publication documents the development of both the State of Iowa Facilities Improvement Corporation and the Iowa School Energy Bank Program.

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 30318, 30739, 30797, 30973, 30974, 30975, 30976, 31001, 31120

30995 (DOE/EIA–0202(89/2Q)) **Short-term energy outlook: Quarterly projections, April 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use. 5 May 1989. 56p. Sponsored by DOE Management & Administration. Order Number DE89012562/JAW. Available from NTIS, PC A04/MF A01 - GPO - OSTI; GPO Dep.

The Energy Information Administration (EIA) quarterly forecasts of short-term energy supply, demand, and prices are revised in January, April, July, and October for publication in the Short-Term Energy Outlook (Outlook). An annual supplement analyzes previous forecast errors, compares recent projections by other forecasters, and discusses current topics of the short-term energy markets (see Short-Term Energy Outlook: Annual Supplement, DOE/EIA-0202). The principal users of the Outlook are managers and energy analysts in private industry and government. The projections in this volume extend through the fourth quarter of 1990. The forecasts are produced using the Short-Term Integrated Forecasting System (STIFS). The STIFS model uses two principal driving mechanisms: a macroeconomic forecast and world oil price assumptions. Macroeconomic forecasts produced by Data Resources, Inc. (DRI), are adjusted by EIA to reflect EIA's assumed world crude oil prices. EIA's Oil Market Simulation Model is used to project world oil prices. The three projections for petroleum supply and demand are based on low, middle, and high crude oil price trajectories. The discussion and tables in this volume refer primarily to the middle, or base case, scenario and, unless otherwise noted, to the domestic situation. Other cases examining the sensitivity of total petroleum demand to varying assumptions about prices, weather, and economic activity are shown in Table 7. Discussions of the world oil price refer to the cost of imported crude oil to US refiners. 19 figs., 18 tabs.

30996 (LBL–25611) **An end-use approach to development of long-term energy demand scenarios for developing countries.** Sathaye, J.; Ketoff, A.; Schipper, L.; Lele, S. Lawrence Berkeley Lab., CA (USA). Feb 1989. 37p. Sponsored by Environmental Protection Agency. DOE Contract AC03-76SF00098. Order Number DE89013360/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In this paper, we explore the contribution of developing countries to the demand side of the problem. We present long-term energy demand scenarios for these countries, spanning a wide range of possible rates of global and regional economic growth. The scenarios are called the Rapidly Changing World (RCW) and the Slowly Changing World (SCW). We also examine the impact on each scenario of policies aimed at improving energy efficiency and reducing energy consuming activities for each scenario. These policy scenarios are called the Slow Policy Case (S/Policy) and the Rapid Policy Case (R/Policy). With these scenarios, other researchers can estimate the extent of climate change that may occur due to the emissions resulting from the energy demands we obtain, and determine whether significant reductions in energy demand will mitigate or at least defer the climate effects, allowing more time to develop alternative energy sources whose climate effects are benign. 23 refs., 9 figs., 12 tabs.

30997 (NEB–23-15) **Canadian energy supply and demand, 1987-2005. Summary.** National Energy Board, Ottawa, ON (Canada). 1988. 27p. (In French). (MICROLOG–89-01284). Available from National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents projections of energy supply and demand, based on consultations with all provincial governments and a wide variety of industry and other interested parties, including utilities, associations, companies, research institutes, and various federal government departments and agencies. The consultations concerned methodology, assumptions as to world oil prices and economic growth, and preliminary projections. The report provides detailed information on the assumptions, methodology, and results of the analysis of supply and demand for natural gas, electricity, crude oil and equivalent natural gas liquids, and coal. Details are given on resources and reserves, prices and costs, domestic demand, exports, production, and imports, as well as end use energy demand by sector and by fuel and region. A summary is included. Definitions, abbreviations, and terms used are also given. 79 figs., 104 tabs.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 30634, 30972, 30977, 30997

30998 (MEM–1988) **Supplementary information for legislative review, 1988-89 estimates.** Manitoba Dept. of Energy and Mines, Winnipeg, MB (Canada). [1989]. 62p. (MICROLOG–89-01517). Available from Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, MB, Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This estimates supplement provides background on the Manitoba Department of Energy and Mines operations and complements information contained in the printed main estimates. The document is organized into three parts: an overview of the budget requirements; a detailed analysis of programs including staffing and expenditure requirements; and a 5-year historical summary of human and financial resources. A summary of staff categories, the responsibilities of

the Department, statutory responsibilities of the Minister, and an organizational chart are also included. 6 figs., 24 tabs.

30999 (NEI-DK–175) **Energy planning 1988. Status report.** Energiministeriet, Copenhagen (Denmark). 1989. 97p. (In Danish). Order Number DE89776159/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

This status report, published by Denmark's Ministry of Energy as background material for the annual statement of energy policy, (upto, and including the year 2010), which it is legally obliged to present to the Danish Parliament, covers the subjects of actual and potential development in relation to energy supplied and consumption especially with regard to oil and natural gas. It also deals in detail with many aspects of electric power production, renewable energy, and oil and natural gas recovery. (AB).

31000 (NEI-DK–176) **Statement on energy policy 1988. Statement by the Ministry of Energy on laws concerning energy policy measures and Danish Oil and Natural Gas A/S.** Energiministeriet, Copenhagen (Denmark). 1989. 22p. (In Danish). Order Number DE89776160/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A brief statement by the Danish Ministry of Energy on the present situation in Denmark and its effect on future policy in the field of energy. The importance of environmental protection, and the lowering of prices, is emphasized in relation to the European Communities' single market. With regard to electric power, it is stated that production must increase in the 1990's, but it will be necessary to reduce costs. There are present economical problems where the natural gas heating project is concerned, and, also because of concern for pollution abatement, it will become more important to use collective heating systems. The statement describes principles and policy in relation to energy consumption, renewable energy, research activities, and oil and natural gas. Lastly, the statement describes the present situation situation and (briefly) future policy with regard to Danish oil and/or natural gas companies, ie. DANGAS, DOPAS, DOFAS, and DORAS. (AB).

31001 (OME–1988) **Ontario Ministry of Energy annual report, 1987/88.** Ontario Ministry of Energy, Toronto, ON (Canada). 1988. 42p. (In English and French). (MICROLOG–89-02318). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, Ont., Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Ontario Ministry of Energy is responsible for devising policies and implementing programs to keep Canada's largest energy consuming market attuned to energy markets and abreast of energy developments. The Ministry has four broad objectives: to ensure an adequate, reasonably priced energy supply, one that has minimal environmental impact, to promote energy conservation and efficiency, to encourage research and development of new energy services and technologies, and to advise the provincial government on energy policy issues. This report highlights the year's activities of the Ministry and provides some insight into how it may influence the future Ontario energy picture. Some of these highlights include a reorganization of the Ministry into seven branches; an initiation of a major review of the legislation governing Ontario Hydro, which was also directed to make specific plans for future development of the Ontario electricity system, especially in light of the changing nature of power demand in the province; introduction of the Energy Efficiency Act, designed to promote a higher level of efficiency in major appliances; and energy-from-waste program; an encouragement of small hydro generation.

31002 (SRBA–1987) **Surface rights board, sixteenth annual report.** Surface Rights Board, Edmonton, AB (Canada). 1987. 21p. (MICROLOG–89-01497). Available from Alberta. Surface Rights Board, 18th Floor, Phipps-McKinnon Bldg., 10020-101A Ave., Edmonton, AB, Canada T5J 3G2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This annual report for the calendar year 1987 presents information on legislative initiatives and amendments, activities of the Chairman, and data on applications for right of entry for mineral recovery (oil, gas, coal), pipelines, and power transmission lines; terminations of rights; and compensation. Also included are a summary of appeals and comparisons with the Energy Resources Conservation Board for well licenses and pipeline permits from 1983-87. 18 tabs.

31003 **Remarks before the Beijing meeting of the pacific basin conference.** Rusche, B.C. (Department of Energy, Washington, DC (USA)); Remarks before the Beijing meeting of the pacific basin conference. *Transactions of the American Nuclear Society (USA)*, 56(1): 27-30 (1988). (CONF-870905–: 6. Pacific Basin nuclear conference, Beijing, China, 7-11 Sep 1987).

A substantial amount of new generating capacity must be added in the United States before the turn of the century. Noting that the light water reactor (LWR) has enjoyed a remarkably good safety record, the United States Department of Energy (DOE) is working actively to restore public and investor confidence in nuclear power. DOE is working with US industry to encourage licensing reform, simplification and standardization of large plant designs, and resolution of the waste management issues. New, more tolerant, lower cost designs are being prepared to share technology advances with other nations under mutually acceptable conditions. The US determined to be a reliable supplier of equipment and enrichment services.

2940 Fossil Fuels

Refer also to citation(s) 30278, 30283, 30300, 30318, 30324, 30325, 30326, 30366, 30367, 30995, 31013, 31014, 31018, 31019, 31027, 31053

31004 (EMR–1986) **Petroleum Incentives Administration annual report, 1986.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1987. 33p. (MICROLOG–89-01869). Available from Petroleum Incentives Administration, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The year under review saw further progress in the implementation of initiatives that were set in motion with the federal government's March 1985 announcement of the termination of the Petroleum Incentives Program (PIP). These initiatives were legislative, operational, and administrative in nature. The report discusses the PIP grandfathering period, the Canadian Ownership and Control Determination (COCD) program, the PIP itself (a total of $1.3317 billion was paid to 3855 applicants), and the Petroleum Incentives Administration (PIA) service to industry. PIA established a western information office in Calgary in 1981. In 1986, 1131 COCD certificates were issued, compared to 1864 in 1985. PIA staff assist applicants and process requests for: ministerial discretions, advance rulings, letters of opinion, approvals of arrangements for equipment and for wells on frontier lands costing more than $50 million. PIA also publishes information. As of December 31, 1986, PIA's permanent staff was 128 compared with 226 in December 1985. 4 figs., 15 tabs.

2950 Hydrogen and Synthetic Fuels

Refer also to citation(s) 31163

2960 Electric Power

Refer also to citation(s) 30677, 30792, 30797, 30805, 30808, 30818, 30819, 31066, 31115

31005 (AD-A–204060/8/XAB) **Mobile electric power technologies for the Army of the future: engines, power source, and electrical aspects.** National Research Council, Washington, DC (USA). 1988. 184p. Available from NTIS, PC A09/MF A01.

Contents include: Introduction to Mobile Electric Power in the Army; System Constraints and Component Interactions; Future Component Technologies; Future Mobile Electric Power Systems; Appendices: Statement of Task, Committee Meetings and Site Visits, Electric Generators, Gas-Turbine Engines, Stirling Engines, Fuel Cells, Batteries, Vehicle Engine Noise.

31006 (BCH–1988) **B.C. Hydro, annual report, 1988.** British Columbia Hydro, Vancouver, BC (Canada). 1988. 74p.

(MICROLOG–89-01021). Available from B.C. Hydro, 970 Burrard St., Vancouver, BC, Canada V6Z 1Y3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The annual report of this Crown corporation presents information on the discounted rates introduced in 1985, the corporation's operations in the international field, environmental considerations, costs, reliability, safety standards, operation of electricity, natural gas, and rail services; exports; and an overview of the 20-year forecast. A financial statement is included. 14 figs., 3 tabs.

31007 (EPRI-CU–6367-Vol.1) **Demand-side management strategies for the 90s: Proceedings: Fourth national conference on utility DSM programs: Volume 1.** Electric Power Research Inst., Palo Alto, CA (USA); Synergic Resources Corp., Bala-Cynwyd, PA (USA). c Apr 1989. 563p. Sponsored by Electric Power Research Institute. (CONF-890510–Vol.1: 4. national conference on utility DSM programs: demand-site management strategies for the 90's, Cincinnati, Ohio, USA, 2-4 May 1989). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

These proceedings contain the papers presented at Demand-Side Management — Strategies for the 90s, the Fourth National Conference on Utility DSM Programs held from May 2 to 4, 1989, in Cincinnati, Ohio. To provide further information on DSM strategies in use around the country, abstracts of those papers which unfortunately could not be included in the conference program are found in the appendix. The conference objectives were to: (1) provide an opportunity for DSM experts to discuss their experience with such programs and their concerns about the regulatory and policy challenges they face, (2) determine how to improve DSM's effectiveness by enhancing performance evaluation methods, (3) explore how effective market research contributes to program success, (4) evaluate what does and doesn't work in marketing and implementing DSM programs, and (5) discuss how DSM can be incorporated into the larger framework of integrated resource and least-cost planning.

31008 (EPRI-EM–5842, pp. 21-40) **Integrated value-based planning.** Gellings, C. Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Competition is changing the marketplace for energy services, with customers' options increasing. As a result, utilities have two choices to avoid customer losses: they can work to lower the price for their product; or they can examine methods to increase customer's value for their product. Planning methods desired to provide service at minimum cost are well understood. But cost is not the only variable in seeking a satisfied customer. The challenge today for the utility planner is integrating these value concepts into the planning process. This presentation examines the complexities involved in developing an integrated value-based planning process. What the characteristics of a successful resource option look like and how EPRI thinks Integrated Value-based Planning may act as a framework to start putting all the pieces of the planning puzzle together. Collected here are photos of the 18 slides used by the author in his presentation.

31009 (EPRI-EM–5842, pp. 41-72) **Least-cost planning: profiting from the negawatt revolution.** Lovins, A.B. (Rocky Mountain Institute, Old Snow Mass, CO (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Electricity-saving technologies, the usual winners in least-cost analyses, have been improving with astonishing speed. They can save much more, at far lower cost, than is commonly assumed. This paper surveys some salient quantitative examples, especially in buildings; new implementation methods and program-design tools; best implementation experience; and policy implications. 3 figures, 5 tables.

31010 (EPRI-EM–5842, pp. 73-93) **Legacy of traditional planning.** Oatman, E.N. (Strategic Decisions Group, Menlo Park, CA (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

When basic, undifferentiated electricity was selling faster than utilities could produce it, enhancing, or even understanding, the perceived value of their product in the marketplace was not the problem. Meeting a demand that doubled in less than a decade – that was the problem. Consequently, what is called traditional planning was steeped in the supply-side values of reliable service and minimum revenue requirements – values born out of regulatory contract that promised, in exchange for providing service upon demand, full recovery of costs and a fail return on investment in productive assets. The Integrated Value-based Planning context of this conference reflects 15 years of reality building and innocence shedding by an industry undergoing a painful transition, if not an upheaval. Intractable uncertainty, uncompensated risks, burdensome costs, and underused capacity have combined with government intervention to produce a hybrid regulated-competitive environment where end-user values become a major driving force. This presentation addresses the legacy of insight from traditional planning that can help Integrated Value-based planners achieve the ultimate planning goal of quality decisions. 3 references, 12 figures.

31011 (EPRI-EM–5842, pp. 95-116) **Integrated resource planning: a view from the trenches.** Hirst, E. (Oak Ridge National Lab., TN (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper discusses the integrated planning process and initial plan developed by Puget Power. Their Demand and Resource Evaluation (DARE) project was announced in early 1986. Planning for the project was conducted during the Spring and work got underway in earnest during the Summer. Fifteen months later the formal report is about to be delivered to the Washington Utilities and Transportation Commission. Puget Power's experience, both with the internal planning process and with analysis of substantive issues, provides insights and lessons for other utilities and state PUCs. A key insight concerns the importance of developing and maintaining cooperation and consensus among the utility's planning and operating departments. Other insights gained during the first year of DARE concern the importance of continuing support and interest in long-term planning from top management, the need to develop improved data on demand and supply resources and the external environment, the need to integrate data and models with corporate experience and judgment, and the need to develop realistic (i.e., modest) expectations for the initial results of an integrated planning process. 8 references, 4 figures, 1 table.

31012 (EPRI-EM–5842, pp. 119-146) **Why utilities should promote DSM while choking on capacity surplus.** Cavanagh, R. (Natural Resources Defense Council, San Francisco, CA (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Capacity-surplus utilities often view demand-side management (DSM) programs as eminently deferrable; the imperative is increasing RWH sales. This perspective overlooks or undervalues compelling reasons for sustaining at least some DSM investments during periods of capacity surplus. These include: (1) the need to avoid irreversible losses of long-lived savings that would have been cost-effective to the utility system; (2) the contribution that DSM investments can make to reducing costly uncertainty about future electricity needs; (3) the potential for using DSM to create more lucrative long-term wholesale power sales opportunities; (4) the

availability of DSM as an effective alternative to rate concessions in retaining customers who are threatening to leave the grid; and (5) the importance of building and maintaining a utility's capacity to deliver predictable, cost-effective savings from all major categories of electricity use. Specific examples from each category are provided, drawing on the author's experience with utilities in California, the Pacific Northwest, and Canada.

31013 (EPRI-EM–5842, pp. 147-156) **Regulatory perspective on integrated value-based planning (IVP).** Swanson, S. (New York State Public Service Commission, Albany, NY (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

IVP is emerging from the efforts of utilities and regulators to develop effective integrated least-cost plans for meeting future energy needs in the context of increasing competition in electricity and gas markets. Many state regulatory commissions have been calling on utilities to develop integrated least-cost plans that consider demand-side management on an equal footing with such other electricity-supply options as independent power production, life extension of existing generating plants, and new power-plant construction. At the same time these regulatory commissions have been reforming regulatory policy to adapt to and, where the effects are beneficial, encourage increasing competition in electricity and gas markets. Integrated value-based planning promises a planning approach that joins these important issues. This presentation reflects the recent experience of the New York State Public Service Commission and reports views of senior staff and Commissioners from the several states represented on the National Association of Regulatory Utility Commissioners' Energy Conservation Committee/ Staff Subcommittee. Mr. Swanson reports results of a focused review of IVP by several leaders from the state regulatory commissions actively pursuing integrated least-cost planning.

31014 (EPRI-EM–5842, pp. 157-167) **What do we really mean by least-cost utility planning?.** Millhone, J. (Department of Energy, Washington, DC (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The US Department of Energy has been directed by Congress to initiate a Least Cost Utility Planning (LCUP) program. DOE has found that the adjective, least-cost, creates foreboding among some utility planners, apparently because the superlative implies a simple exactness not found in the real world. Nevertheless, LCUP is a term whose time has come. Legislative, regulative, and literature references to the term are sweeping the country. Therefore, it's wiser to accept the term and define it broadly and flexibly, rather than to demure on semantics, Mr. Millhone feels. From the outset of the new program, DOE has defined least cost to include load shifting as well as increased efficiency, to require risk assessments, to involve robust strategies that look good under a variety of alternative futures, and to allow load building when the long-term effects are also beneficial. The term, Integrated Value-Based Planning, is a reasonable evolution of the concept. It recognized that the goal should be the maximization of value of the services received. It recognizes explicitly that it's appropriate to market electricity when the values obtained are positive, relative to alternatives, in meeting recognized customer needs. This paper summarizes DOE's LCUP program and draws on work by DOE's national laboratories, contractors and grantees to illustrate the changing definition of least-cost utility planning. 6 references.

31015 (EPRI-EM–5842, pp. 171-183) **Forecasting and validating participation rates over time.** Flaim, T. (Niagara Mohawk Power Corporation, Syracuse, NY (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper addresses the issues associated with forecasting and validating participation rates for demand-side programs designed for residential customers. The problem can be viewed as three separate phases of analysis: (1) developing forecasting tools, (2) forecasting participation rates to evaluate both program effects, and (3) the accuracy of the forecasting tools. To develop a forecasting tool for residential customers, Niagara Mohawk is funding the Research Triangle Institute to extend its Residential Appliance Market Penetration (RAMP) Model to include electric appliances as well as space-conditioning systems. Distilled to basics, RAMP develops models of household satisfaction (utility) associated with consuming energy services and all other goods (modeled as income after deducting energy-related expenses). The second step in the process is to forecast estimates of participation rates over time. The model automatically updates information such as how the existing appliance stock ages over time. The final phase of analysis is to validate participation rates, or, more specifically, to validate the number of participating customers per dollar of program cost. One step in the analysis is to do an ex post assessment of the base-case forecast in order to estimate what would have happened without the program. 1 reference, 4 figures, 1 table.

31016 (EPRI-EM–5842, pp. 185-203) **Demand-side management audit: improving the estimates of DSM impacts.** Limaye, D.R. (Synergic Resources Corporation, Bala Cynwyd, PA (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The Demand-Side Management Audit (DSM Audit) represents a thorough evaluation of existing (or proposed) programs to quantify unit energy and load impacts per participant, estimate program costs and incentives, assess the time path of market penetration, and develop overall estimates of kW and kWh impacts and related total costs. Using information from recent studies for the City of Austin, TX and Northeast Utilities, this paper describes the concepts and applications of the DSM Audit and describes how it can be used to refine estimates of DSM impacts and reduce the uncertainties in impact estimates. The City of Austin DSM Audit indicated that a load reduction of 43 MW had been achieved through five major DSM programs. The Audit estimated that the continued operation of these programs would produce an additional 67 MW load reduction. The paper also explores potential extensions of the DSM audit approach to assess the value to the customers of various DSM options and utility programs to promote these options. 7 figures.

31017 (EPRI-EM–5842, pp. 205-218) **Information needs for value-based planning.** Bentley, J.C. (Florida Power & Light Company, Miami (USA)); Evelyn, J.C. Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Several pieces of information are required in order to pursue value-based planning. One of the critical pieces of information concerns the kW demand for certain end uses. These data are needed to not only help the customer understand his energy use and properly analyze alternatives, but also to enable the utility to perform the appropriate cost-benefit analysis. This paper reviews traditional methods such as end-use metering and more recent approaches using statistical techniques. Comparisons are made on the relative accuracy, cost, and other criteria. The paper shows that, in certain circumstances, more recent techniques offer significant accuracy or usefulness. The studies helped FPL better understand customer's attitudes and behavior. Behavior is described through the time/ quantity dimension, or load shapes, while attitudes are described through the value customers place on product attributes, a function of new technology.

31018 (EPRI-EM–5842, pp. 223-232) **Regulation of utility long-range planning.** Wiel, S. (Nevada Public Service Commission, Carson City (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A utility company now has technically and economically viable options to reduce the per-capita consumption of electricity through conservation measures, to avoid the need for additional electric generation through load-management measures and through generating capacity available within some of its customers' facilities, and to provide new generation from qualifying facilities (under PURPA) and independent power producers. More complex planning and vastly greater customer involvement are needed in varying degrees. One fundamental question is, How open to the Commission and the public should the utility's planning be? Commissions across the country are more and more answering, the planning must be done in a goldfish bowl with input from whoever would like to provide it. How else can a utility demonstrate that the investment strategy it plucks from this complex myriad of choices will truly provide the lowest possible utility bills for its customers. Sophisticated planning is necessary to select among investment opportunities that require increasing interaction with the customer.

31019 (EPRI-EM–5842, pp. 271-294) **Customer segmentation.** Fuller, K.E. (New York State Electric & Gas Corporation, Binghamton (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper discusses the practical considerations that are involved in targeting a market. To make effective use of marketing budgets, analysts need to use the latest market research tools while also taking advantage of commonly available information about the demographic and geographic characteristics of their service areas. There are a variety of ways to reach an audience. The advertising message can be varied; the vehicle for transmitting the message can be changed; the mix of advertising, direct contact, and incentives can be varied; and the emphasis and message can be changed by geographic location. All of these factors should be considered. New York State Electric and Gas is the site for the Residual Electric Thermal Storage demonstration of EPRI's Customer Preference and Behavior Project. The results of this project will serve as an important part of the customer targeting process, but utilities will never be able to use a cookie-cutter approach to customer segmentation. 4 references, 3 figures, 3 tables.

31020 (EPRI-EM–5842, pp. 307-319) **Planning for electric utilities; the value of service.** Read, J. (Incentives Research, Inc., Cambridge, MA (USA)); Graves, F.C. Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Value-based planning is the norm in unregulated industries, so it is not surprising that competition is the stimulus for value-based planning in public utilities. The thesis of this paper, however, is that the value-of-service issues are implicit in virtually all supply alternatives. Furthermore, once the value-of-service dimension is recognized, the fact that electric service has multiple attributes becomes clear, as does the need for marketing research. This paper has several objectives. First, it describes the relationship between cost-based and value-based planning criteria, in particular, the conditions under which cost-based planning yields value-maximization decisions. Second, it points out that there is an important link between pricing policies and the service attributes of power-supply alternatives; this means that, among other things, rigid ratemaking policies limit the potential value of many power-supply alternatives. Finally, it discusses obstacles in the transition from cost-based to value-based planning procedures. 2 references

31021 (EPRI-EM–5842, pp. 321-338) **End-use evaluation.** Kolbe, A.L. (Putnam, Hayes & Bartlett, Cambridge, MA (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

A demand-side program is one in which the utility actively promotes efforts to change the shape of the load curve or to reduce electricity consumption. Typically, in deciding whether to undertake such demand-side programs, a comparison is made between the present value of the cost of meeting a given reliability standard by new capacity versus utility measures to change load shape or cut demand. But following participation in a demand-side program, customers may find comfort or convenience reduced. Furthermore, customers may have to bear some of the monetary cost on their side of the meter. Should utilities and their regulatory commissions factor such forces into their evaluations? If so, how? Are there lessons from unregulated markets that bear on these issues? An attempt is made to answer these and similar questions. There are two specific goals in the paper: (1) identify the conceptually correct way to evaluate program tradeoffs from the perspective of economic theory; consumer satisfaction is explicitly considered; and (2) examine the unregulated markets to find what lessons they provide with respect to end-user well-being. 2 figures.

31022 (EPRI-EM–5842, pp. 339-357) **Strategic planning framework for technology evaluation.** Abrahamson, P. (Applied Decision Analysis, Menlo Park, CA (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Planning in the electric-utility industry has been based traditionally on the goal of cost minimization. More recently, criteria such as least-cost planning and value-based planning have been advocated. However, the context of the planning problem itself greatly complicates the task, independent of the criterion or criteria used to evaluate the chosen plan. This paper addresses the overall context of the planning problem, characterized by significant uncertainties in future state-of-the-world events, customer behavior, and technology cost and performance. It proposes a framework for integrating these uncertainties into the planning process. The key features of the approach include: describing an appropriately broad set of possible futures, identifying key threats and opportunities, and developing strategies that incorporate explicitly the flexibility needed to respond to threats and capitalize on opportunities. The paper consists mostly of photos of 12 slides that were used in the presentation.

31023 (EPRI-EM–5842, pp. 363-380) **Importance of market segmentation in new service and rate offerings.** Caves, D.W. (L. Christensen Associates, Madison, WI (USA)); Herriges, J.A.; Windle, R.J.; Christensen, L. Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Among the underlying characteristics of Integrated Value-Based Planning (IVP), and the closely related Priority Service Concept (PRISM), is the principle that customers be given a selection or menu of price and service offerings. The advantage of these schemes, in principle, is that they encourage changes in usage patterns that lead to a closer match between the marginal cost of service an the value of service to individual customers. But in practice the menu characteristic can cause the serious side-effect of net revenue erosion for the utility. In this paper, the net-revenue-erosion problem and the importance of market segmentation are demonstrated in the context of two candidate IVP programs – commercial/industrial interruptible service and residential voluntary time-of-use

rates. Both demonstrations draw on results of recent EPRI studies of actual customer behavior, which are used to identify market segments for which the net revenue erosion problem can be serious. The paper presents an estimate of the potential magnitude of the problem and suggests ways that market segmentation research can be employed to minimize the potential net revenue erosion aspects of IVP implementations. 7 references, 6 figures.

31024 (EPRI-EM–5842, pp. 381-394) **Value of product differentiation in electricity markets.** Borison, A. (Applied Decision Analysis, Inc., Menlo Park, CA (USA)); Morris, P. Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Over the past few years, utilities have moved from commodity orientation to product differentiation by customizing electricity services for specific customer groups, namely: (1) lower reliability (and lower rates) to industrial customers through negotiated interruptible rates; (2) higher quality and reliability (at increased cost) to commercial customers with sensitive electronics through back up generation and power conditioning equipment, and (3) quantity limits (and appropriate rebates) to residential customers through demand subscription-service programs. While these programs address important utility and customer needs, specialized services for limited groups represent a relatively small change in electricity making. The power of product differentiation is captured more completely when all customers can choose the type of service best suited to each portion of their electricity needs. This paper presents an illustrative example of full-scale product differentiation. A menu of electricity services with substantial differences in quality and reliability is described. Customer selections from this menu are predicted, and utility operations required to deliver these services are outlined. Then, the impacts on utility finances, customer costs, and customer satisfaction are evaluated. This example demonstrates the value of product differentiation in electricity markets.

31025 (EPRI-EM–5842, pp. 403-439) **Integrated resource planning: who's going to do it?.** Collier, J.C. Jr. (Florida Power & Light Company, Miami (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper looks briefly at traditional utility planning parameters, the changes that have occurred or are projected to occur in these parameters, and the impact of these changes on utility organization cultures. Regulators, competitive forces, and practical business consideration will require utilities to demonstrate that they have performed (least cost) or integrated planning in preparation for meeting customer requirements. Many utilities have not integrated their planning processes and are not organized to effectively accomplish this integration without impact on organization and culture. The paper is divided into four sections as follows: (1) review of traditional utility planning boundaries and options considered, focusing on supply-side issues; (2) development of expanded utility planning boundaries including many new supply-side alternatives as well as new demand-side options; (3) using results of a survey of major utilities demonstrate where responsibilities for the major components of planning currently reside; and (4) to suggest one proposed approach toward solving the organization and cultural problems described in the 3rd section, namely: an integrated planning effort that involves appropriate departments and individuals each given advocacy responsibility for an alternative option. 21 figures, 1 table.

31026 (EPRI-EM–5842, pp. 441-461) **Pricing - the marketing facilitator.** Laun, J. (San Diego Gas & Electric, CA (USA)); Haddow, G. Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper reviews the prerequisites for success in a competitive utility industry and a case study of the transformation of San Diego Gas & Electric (SDG&E) into a utility geared to address the competition. Within the new utility environment, SDG&E is meeting the needs of its customers by pursuing market-based pricing structures, acquiring greater insights into the needs of the customer, and intensifying the segmentation of the utility market to serve these needs. These innovative marketing strategies place a heavy reliance on the use of pricing as a marketing tool. Implementing these marketing strategies has necessitated fundamental changes to the external (regulatory) utility environment, the internal (corporate) organizational environment, and to the business philosophies and corporate strategies of the utility and its regulators.

31027 (EPRI-EM–5842, pp. 465-477) **Corporate considerations related to competition: reshaping the corporation from the inside out.** Shikuma, R. (Pacific Gas & Electric Company, San Francisco, CA (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Mr. Shikuma discusses the changes and adaptation at Pacific Gas & Electric (PG&E) to respond to a more competitive environment. PG&E is facing many of the same competitive challenges as other utilities. Both the gas and electric business are highly competitive. The entire spectrum of strategies for adaptation were examined and several are being pursued. The one this paper focuses on is somewhat different from most being discussed in that, if completely successful, PG&E will look much the same to the outside world. Management is engaged in reshaping the internal structure of PG&E in fundamental ways. The goal is to manage existing assets with the maximum possible efficiency and to shape the entire organization into one focused on delivering service to their customers. Every one of the products, services, systems, procedures, and structures is being systematically dissected and examined, and perhaps reconstructed differently. This is not an expedient, but an essential part of their competitive strategy.

31028 (EPRI-EM–5842, pp. 479-504) **FPL Group - a case study of diversification.** Walker, B. (Florida Power & Light Group, Tallahassee (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper reports a case study – that of FPL Group, Inc. – of utility diversification. This includes the reasons the company (Florida Power & Light Company) decided to diversify in 1984, the organization that was created including a description of the major subsidiaries, and the major issues that have been raised as a result of this diversification, mostly as a result of entry into the competitive market, before the Florida Public Service Commission and the Florida Legislature. The paper concludes that both the stockholders of the corporation and the utility ratepayers are benefited from this diversification effort. 1 figure.

31029 (EPRI-EM–5842, pp. 507-523) **Developing a pricing strategy: the case of nonutility generation.** Chamberlain, J. (Barakat, Howard & Chamberlain, Inc., Oakland, CA (USA)). Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The traditional rate design process has been one that focuses upon the allocation of the revenue requirement to projected sales. While attention is generally given to other goals such as rate stability and equity of the rates, the development of rate structures designed to recover the revenue requirement has been the primary element of the rate-design process. As utility markets become more

competitive, this process must give way to a more strategic view of rates. Traditional rates will not recover costs when customers are encouraged to bypass the system, or meet their energy service needs through sources other than the utility. However, rates can be developed which seek to influence the market position of the utility. This paper outlines a strategic rate-design process, and illustrates its use by discussing the development of strategic rates for qualified facilities (QFs).

31030 (EPRI-EM–5842, pp. 527-545) **Bulk power contracts: valuing reliability.** Iveson, R. Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The history of competition for use of the bulk-power transmission system is one of the best kept secrets in today's utility world. The evolving issues of deregulation, increased competition, customer costs, and utility needs have brought into public view the technical, economic, and regulatory complexities of bulk power purchases and sales. This paper presents examples of the diversity and creativity of present utility bulk-power contracts. It indicates the role reliability plays or fails to play in such contracts and the several methods of valuing reliability. Looking to the future, it develops scenarios in which the marriage of technology and economic theory may achieve even more complex arrangements which will challenge the analytic capabilities of the system planner, the response capabilities of the system operator, the economic ingenuity of the rate maker; and the egalitarian wisdom of the policy maker. 4 references, 9 figures.

31031 (LITH-IKP-EX–680) **Industrial load management in the Broby area.** Heino, P.; Knutsson, R. Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering. 11 Nov 1987. 78p. (In Swedish). Order Number DE89766898/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

Examination paper.

The thesis introductory presents the conditions for the initiation of the work. The delimits and the way of handling the subject are described followed by some more general chapters about load management. Some different load management measures are described. The most important part of the work is concentrated at the study of practical load management for industrial high voltage customers in the Broby area. The measures are described for each company. The entire load management potential for high voltage customers in the Broby area is about 18%. The total demand reduction for the companies is approx 1500 kW. An estimation of the load management potential for the Sydkraft distribution area is about 10 %. HAKI Produkter AB can reduce their electricity cost by approx SEK 50 000 per year by rescheduling a steam boiler. This is calculated with help of INDSIM (Sydkraft rate N3, 1987). With help of rescheduling and load priority, SAAB-Scania AB is able to lower their yearly electricity cost by approx SEK 61 000 (INDSIM, Sydkraft rate T2, 1987) An adequate demand boundary in future company selection is proposed to be around 1000 kW (subscribed effect) (authors).

31032 (OH/EF–269) **Cost escalators. Annual review.** Ontario Hydro, Toronto, ON (Canada). Economics and Forecast Div. 1988. 63p. (MICROLOG–89-01317). Available from Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This annual review was first introduced in October 1984 to consolidate all of the projections of prices and wages that are relevant for Ontario Hydro planning and budgeting. The cost variables include Ontario Hydro's construction indices; operation, maintenance, and administration indices; interest rates; Canadian and Ontario aggregate wages and prices; industrial selling prices and wages; and aggregate wage escalation and price inflation for Japan, Switzerland, the United Kingdom, and West Germany. This review provides forecasts for 1987-2025. Short commentaries are presented on major trends and alternative scenario forecasts are given for a number of selected Ontario Hydro cost indices. 81 tabs.

31033 (PB–89-159305/XAB) **Power shortages in developing countries: magnitude, impacts, solutions, and the role of the private sector: a report to Congress.** Agency for International Development, Washington, DC (USA). Mar 1988. 94p. Available from NTIS, PC A05/MF A01.

The need to provide adequate electricity in developing countries is of critical importance to the U.S. Energy is critical for sustainable economic development. As growth proceeds, developing countries require more electric power to satisfy the requirements of their agricultural, industrial, transport, and commercial sectors. As a prerequisite for economic development, electric power is vital to efforts to improve living standards in the Third World and to satisfy the demands of their citizens within a stable political context. Also, the electric power market in developing countries provides significant trade opportunities for U.S. businesses. In response to the Congressional request, this report highlights the dilemma faced by developing countries and seeks to initiate a discussion about potential solutions, the appropriate role of the private sector, and implications for the U.S. foreign-assistance program.

31034 (STEV–1988-R15) **Electric power market report 1988.** Statens Energiverk, Stockholm (Sweden). 1988. 213p. (In Swedish). Order Number DE89766907/JAW. Available from NTIS (US Sales Only), PC A10/MF A01;1.

A report on matters related to production and consumption of electric energy in Sweden. The following aspects are covered: The development of cogeneration in industry and combined power and district heating generation in public heat and power utilities; The implementation of plans for new hydro power generation capacity; The trends in electric power demand; and the addition of new generating capacity. One main objective for the electric utilities is to reduce the growth of the power demand during the 1990s through introduction of differentiated, and generally increased, prices, in order to cope with the nuclear power phaseout which is planned to begin 1995.

31035 **WRATES.** Caramanis, M.C. (Boston Univ., Boston, MA (US)); Roukos, N.; Schweppe, F.C. *IEEE Transactions on Power Systems (USA),* 4(2): 594-605 (May 1989).

Wheeling in general, and the establishment of wheeling rates in particular, are subjects of extensive debate today. This paper describes a computer program, WRATES, which can be used to evaluate the marginal cost of wheeling between utilities, private users, and private generators; taking into consideration the effects of Kirchoff's laws on transmission line flows, losses and over loads. WRATES can evaluate the resulting marginal cost based wheeling rates using options for incorporating the effect of capital recovery; that includes network only or network and generators with various levels of disaggregation. The theory underlying WRATES is general and suitable for on-line implementation. However, WRATES itself is a PC based user friendly program designed for policy type studies (present version is for a 25 bus, 200 line, 5 utility system solved using a DC load flow).

2980 Consumption and Utilization

31036 (DOE/BP/13795–20) **Lessons learned from monitoring electricity use in multifamily residences: End-Use Load and Consumer Assessment Program (ELCAP).** Pacific Northwest Lab., Richland, WA (USA). Jun 1989. 32p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AI79-83BP13795;AC06-76RL01830. Order Number DE89013040/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The multifamily report is one in a series of reports that describe case studies in the End-Use Load and Consumer Assessment Program (ELCAP). This report draws together observations on the process followed in collecting hourly end-use data in multifamily buildings, explains the evolution of multifamily metering, and provides and example of the data obtained. 7 refs., 7 figs., 2 tabs.

31037 (INIS-BR–1477) **National Energy Balance - 1980.** Anon. Ministerio das Minas e Energia, Brasilia, DF (Brazil). 1980. 106p. (In Portuguese). Order Number DE89614683/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The energy fluxes of several primary and secondary energy sources, since the production to the final consumption in the main

economic sectors, are presented. The forecasting of uranium concentrate consumption and production is made for six years - 1980 to 1985. (E.G.).

31038 (LBL–25558) **The sum of megabytes equals gigawatts: Energy consumption and efficiency of office PC's and related equipment.** Norford, L.K.; Rabl, A.; Harris, J.; Roturier, J. Lawrence Berkeley Lab., CA (USA). Jan 1988. 21p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE89013361/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The "other" end-use category represents up to 25% of electricity use in new US office buildings. Office electronic equipment, including mainframe and personal computers, peripherals, copy machines, and communications equipment, may account for 5 to 20% of daytime electrical loads in new offices, and is one of the fastest-growing components of commercial sector electricity use and peak demand. As an important element of the "other" end-use, electronic office equipment merits recognition as a distinct end-use, based on its aggregate energy consumption, contribution to peak demand growth, and potential for improved energy efficiency. 37 refs., 3 figs., 2 tabs.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 30674

31039 (DOE/OR/21389–17) **Resource recovery facility siting: Recommendations for economic and other equity adjustments: Final report.** White, A.L.; Goldstein, J. Energy Systems Research Group, Inc., Boston, MA (USA); Alternative Resources, Inc., Concord, MA (USA). Apr 1989. 87p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG05-83OR21389. (ESRG–87-102). Order Number DE89012957/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The prevailing view among states has historically been that conventional environmental impact review (EIR) processes are adequate to address equity issues arising from resource recovery projects. As siting and project development has become increasingly contentious, however, serious doubt has been cast on this premise, and lack of attention to equity issues has emerged as a fundamental shortcoming in procedures currently in place. Our objective in this report is to address this problem by providing guidelines for formulating workable equity adjustments for host communities and thus enhance the prospects for successful siting agreements throughout the Northeast region. The remainder of this report is divided into seven sections. Following this introduction, Section 2 describes the actual and perceived risks and/or impacts of resource recovery facilities. It is these risks and impacts that must be addressed in an equity adjustment program. Section 3 discusses the various equity adjustment approaches available to offset (or compensate for) these risks. This is followed in Section 4 by a survey of equity adjustment practices currently in use at resource recovery facilities within the Northeast. Section 5 reviews such practices in developing other types of potentially hazardous facilities. 14 tabs.

31040 (EMR/RE–8702) **Proceedings of the 6th Canadian bioenergy research and development seminar.** Hayes, R.D. Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1987. 9p. (CONF-8702152–: ;MICROLOG–89-00769;CE–02569). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The strategic planning exercise for bioenergy R&D has changed considerably since pre-1984, when federal funding levels were approaching $22million/y, following the 1984 government cutbacks in energy R&D to a level of approximately $8million/y, a number of departments were forced to reduce or totally withdraw their funding support from the program. Two other factors added significantly to the venture in formulating a strategic plan. These were the government's priorities to accommodate provincial interests, and to increase involvement of Canadian industry in R&D by various means, including the offering of cost-shared R&D. An interdepartmental working group formulated a comprehensive strategic plan early in 1985 which was revised in January 1987. The remaining of this report is a capsule view of that strategic plan: biomass resources, biochemical conversion (anaerobi digestion, ethanol, and fermentation chemicals), thermochemical conversion, combustion, solid fuels processing/handling, biomass production, International Energy Agency and National Advisory Committee on Bioenergy. A table of actual and proposed expenditures is given at the end of the report. 1 tab.

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

31041 (DOE/ET/10815–127) **Magnetohydrodynamics Coal-Fired Flow Facility: Quarterly technical progress report, October–December 1988.** Tennessee Univ., Tullahoma, TN (USA). Space Inst. May 1989. 33p. Sponsored by DOE Fossil Energy. DOE Contract AC02-79ET10815. (UTSI–89-01). Order Number DE89013117/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Progress on a multi-task development program directed toward the steam bottoming cycle of the MHD Steam Combined Cycle Power Plant is reported. A 100 hour proof-of-concept (POC) test is reported that was primarily intended to evaluate the effect of increased sootblower air pressure on the effectiveness of blowing deposits in the molten temperature range. Modifications to the electrostatic precipitator deposits removal system were also evaluated for effectiveness. Results of analyses of the test heat transfer tubes previously removed are summarized. The effectiveness of electrostatic precipitator and baghouse in particulate removal is discussed. Utilization of and results from advanced diagnostics equipment in LMF4-P that was provided by both Mississippi State University and UTSI are reported. The environmental program status is reported, emphasizing the air quality monitoring and terrestrial ecology results. Maintenance and facility modifications underway in the DOE CFFF are summarized. 14 figs., 2 tabs.

31042 (DOE/FE–0129) **MHD [magnetohydrodynamics] Program Plan, FY 1989.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Special Technologies. May 1989. 38p. Sponsored by DOE Fossil Energy. Order Number DE89012232/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The essential elements of the current program, which is a continuation of the program outlined in the FY 1988 MHD Program Plan, are to: develop technical and environmental data for the integrated MHD topping cycle system through long-term (1000 hours) POC testing; develop technical and environmental data for the integrated MHD bottoming cycle subsystem through long-term (4000 hours) POC testing; design and construct a seed regeneration system capable of independent operation, using spent seed materials from the MHD process; prepare a conceptual design for an MHD retrofit plant; and continue system studies and supporting research necessary for system testing. Results of the topping cycle POC tests at the Component Development and Integration Facility (CDIF), coupled with the bottoming cycle POC test results obtained at the Coal Fired Flow Facility (CFFF), and the seed regeneration POC effort will provide the critical engineering data base for the private sector's final decision on proceeding with the design, construction, and operation of an MHD retrofit. The development schedule, decision points, and resource requirements are discussed. As part of the MHD program, international activities of several nations are monitored and evaluated through contact with the international MHD scientific and technical community. 6 figs.

3005 Fuel Cells

Refer also to citation(s) 30989, 31243

31043 (DOE/MC/24261–2672) **Development of ternary alloy cathode catalysts for phosphoric acid fuel cells: Final report.**

Giner, Inc., Waltham, MA (USA). Nov 1988. 80p. Sponsored by DOE Fossil Energy. DOE Contract AC21-82MC24261. Order Number DE89000926/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The overall objective of the program was the identification development and incorporation of high activity platinum ternary alloys on corrosion resistant supports, for use in advanced phosphoric acid fuel cells. Two high activity ternary alloys, Pr-Cr-Ce and Pt-Ni-Co, both supported on Vulcan XC-72, were identified during the course of the program. The Pr-Ni-Co system was selected for optimization, including preparation and evaluation on corrosion resistant supports such as 2700°C heat-treated Vulcan XC-72 and 2700° heat-treated Black Pearls 2000. A series of tests identified optimum metal ratios, heat-treatment temperatures and heat-treatment atmospheres for the Pr-Ni-Co system. During characterization testing, it was discovered that approximately 50% of the nickel and cobalt present in the starting material could be removed, subsequent to alloy formation, without degrading performance. Extremely stable full cell performance was observed for the Pt-Ni-Co system during a 10,000 hour atmosphere pressure life test. Several theories are proposed to explain the enhancement in activity due to alloy formation. Recommendations are made for future research in this area. 62 refs., 23 figs., 27 tabs.

31044 (NEI-DK–163) **Fuel cells for use in the field of transportation. American initiatives.** Schuetz, P. Energilaboratoriet, Odense (Denmark). Jan 1989. 78p. (In Danish). Order Number DE89766864/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

EFP-88.

The aim has been to observe developments in American technology in relation to the utilization of fuel cells in vehicles such as busses and cars in order to reduce air pollution, improve the nation's economy and reduce dependence on other countries for fuel supplies. After a brief, general description, two American articles on the subject are presented. (AB).

31045 (OME–8804, pp. 17) **Participation of the Hydrogen Industry Council. At the round table of the Fuel Cell Workshop.** Champagne, R.D. Ontario Ministry of Energy, Toronto, ON (Canada); Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1988. (CONF-8804262–: Fuel cells workshop, Toronto, Canada, 28 Apr 1988;MICROLOG–89-00395). In *Fuel cells: potential opportunities in Canada.* Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Can.

This paper discusses the current status of fuel cell technologies, application opportunities, and development and demonstration projects. In spite of currently tolerable fuel prices, fuel cell demonstration projects should be mounted as soon as possible for several reasons, including: the inherent environmental advantages of fuel cells as quiet, non-polluting electrical generators; the competitive position of Canada among industrial nations; and the likelihood of increasing conventional fuel prices within the 15-year lead time comtemplated for the development and demonstration program. The implementation and success of the program depend on sustained commitment and collaboration of governments, primarily federal, in funding the demonstrations, and private organizations in performing the work. The proposed development and demonstration of fuel cells in Canada include portable generators, 5 to 10kW and mobile generators including submersible 10 to 50 kW. Demonstration of these types could presumably be mounted in a reasonably early time frame. Utilities favour fuel cell power plants for cogeneration and remote communities, 25 to 1000 kW. Options here are development of large alkaline fuel cells, importing phosphoric acid fuel cells from the U.S. or waiting for molten carbonate fuel cells or solid oxide fuel cells. The paper discusses the current status of fuel cell technologies, application opportunities and development and demonstration projects. 10 tabs.

31046 (PB–89-178750/XAB) **Electrochemical oxidation of methane at metal and oxide electrodes. Annual report, December 1, 1987-December 1, 1988.** Summers, D.P.; Pound, B.G.; Frese, K.W. SRI International, Menlo Park, CA (USA). Mar 1989. 113p. Available from NTIS, PC A06/MF A01.

See also PB–88-173893.

Electrochemical oxidation of methane at noble metal electrodes was investigated. Auger electron spectra showed no buildup of carbon on Rh electrodes after extended electroysis in 140C H_3PO_4. The surface oxidation of Rh in 140C H_3PO_4 was studied. The open-circuit potential decay method was applied to the reaction between surface oxygen species on Pt and Rh and CH_4, C_2H_6, and C_3H_8, and H_2. Methane was the least reactive hydrocarbon. The peak oxidation currents at 1 atm gas pressure were: 480 micro A cm/sq, 110 micro A cm/sq, 3.5 micro A cm/sq, for propane, ethane, and methane, respectively. Methane oxidation to CO_2 at Rh surfaces onsets at 0.3 V vs. SCE, is maximal at 0.7 to 0.8 V, and then declines at higher anodic potentials. The rising portion of the rate characteristic precedes detectible oxygen deposition, but the drop in oxidation is correlated with blocking of sites with adsorbed oxygen species.

31047 (PB–89-178768/XAB) **Electrochemical characteristics of acid electrolytes for fuel cells. Final report, August 1, 1985-December 31, 1988.** Razaq, M.; Razaq, A.; Yeager, E. Case Western Reserve Univ., Cleveland, OH (USA). Case Center for Electrochemical Sciences. Jan 1989. 214p. Available from NTIS, PC A10/MF A01.

See also PB–88-104641.

Electrochemical characterization of a number of perfluorinated acids has been carried out with the emphasis on the identification of alternate acids which may replace the presently used H_3PO_4 in the H_2-O_2 fuel cells. The kinetics of O_2 reduction in the clean perfluorinated acids on smooth Pt and on high surface area Pt catalyzed electrodes (10% Pt on Vulcan XC-72) has been found to be much faster than in phosphoric acid. The potential of the O_2 cathode in the micro-fuel cell utilizating some of the new acids particularly, $CF_3PO(OH)_2$, $(CF_3SO_2)_2NH$, $(CF_3SO_2)_2CH_2$ and $(CF_3SO_2NHSO_2CF_2CF_2)_2$ is 40-60 mV higher than H_3PO_4; over an order of magnitude and a factor of 5 to 6 respectively. The specific conductivities of the dilute perfluorinated acids are higher than phosphoric acid whereas the specific conductivities of the concentrated perfluorinated acids, particularly the imides, are lower than 85% phosphoric acid. A number of the perfluorinated acids used as minor additives to 85% H_3PO_4 have been found to improve significantly the performance of the oxygen cathode. The approach of achieving higher performance for the phosphoric acid fuel cell is very promising but is contingent on identifying surfactant-like additives with very low intrinsic vapor pressure and stability at elevated temperatures.

31048 Metal/zirconia interfacial reactions in solid oxide fuel cell anodes. Ross, P.N. (Materials and Chemicals Sciences Div., Lawrence Berkeley Lab., Berkeley, CA (US)); Bardi, U. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

The anode material in high temperature (900-2000^{0}C) solid oxide fuel cells (SOFC) is a transition metal (e.g. nickel) stabilized with a ceramic oxide (e.g. chromia). Recently obtained thermodynamic data for certain classes of intermetallic compounds suggests that at SOFC operating temperatures and at reducing gas compositions solid state reactions should occur between the metal and the zirconia electrolyte leading to partial oxide reduction and intermetallic phase formation along the metal/zirconia interface. Our approach to the study of this possible metal/zirconia interfacial chemistry, and its influence on electro-oxidation activity, was to use thin film geometries as model systems for the real fuel cell anode and to use Auger and x-ray photoelectron spectroscopy to observe the reaction progress. Thin films of ceramic were deposited on metal single crystals and annealed in a hydrogen atmosphere at fuel cell operating temperatures. Likewise, thin metal films were deposited on single crystal zirconia and annealed in hydrogen. The use of single crystals made definitive identification of new phase formation possible by use of electron diffraction methods. The metal-on-zirconia systems were studied to determine the reactions occurring and phases forming when the zirconia was in excess, with the opposite being the case for zirconia-on-metal films. These extremes of stoichiometry simulate the heterogeneous environment of the metal in the working anode of the fuel cell. The interfacial reactions and chemisorption behavior of the surface were studied using an environmental cell coupled to a UHV surface analytical chamber.

31049 Systems analyses for high-temperature fuel cells. Krumpelt, M. (Argonne National Lab., Argonne, IL (US)); Daniels, E.J.; Dennis, C.B.; Pierce, R.D. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

Molten Carbonate (MCFC) and Solid Oxide Fuel Cells (SOFC), fueled by natural gas, appear to have excellent attributes for industrial applications. High electrical efficiency, modularity, and by-product heat of high quality are expected to favor them over conventional technology. However, gas turbines have been steadily improved in recent years, and approach or even exceed the efficiency of fuel cells in some cases. The authors have analyzed fuel cell and turbine systems side by side in a generic cogeneration application with the objective of determining performance and cost goals for the high-temperature fuel cells. The application was defined as a process consuming 20 MW of electricity and 20 MW of 0.5 MPa (75 psi) steam. Four cases were considered: (1) an internally reforming, ambient pressure MCFC system with waste heat boilers, (2) a pressurized MCFC system bottomed by gas and steam turbines, (3) a similar system for SOFC's, and (4) a gas and steam turbine combination without any fuel cells.

31050 Controlled electrolyte environments and their use for studying and modifying materials properties. Deublein, G. (Dept. of Materials Science and Engineering, Stanford Univ., Stanford, CA (US)); Liaw, B.Y.; Huggins, R.A. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

In order to effectively utilize electrochemical methods for evaluation and modification of material properties it is important that the interface between the electrolyte and the materials to be studied or modified be controlled so that no reactions can proceed except for those that are electrochemically desired. Especially interesting for this purpose are molten salt electrolytes containing hydride ions. It has been shown recently that both thermodynamic considerations and experiments indicate that they can produce extremely low oxygen and water activities. In this environment, hydrogen-blocking oxides on metal surfaces are thermodynamically unstable and are removed from most metals. As a result, such metals can be considered to be immune, and their surfaces become transparent to hydrogen. Under these conditions, hydrogen can be electrochemically reacted with, as well as dissolved in, many metals. Thus, in such cases, a number of common and inexpensive metals can exhibit similar behavior to that generally attributed to palladium in aqueous environments. The very fast kinetics of the transport of hydrogen in a number of metals with oxide-free surfaces can be employed in novel electrolyte/electrode combinations that may have important practical implications. Since the electrode materials are common ductile metals, they could easily be fabricated into high surface area shapes, such as thin sheets or concentric small diameter tubes, with only a thin layer of electrolyte in between. Thus, it is possible to consider designs that would give large power densities. The general characteristics, critical features, and examples of several types of applications based upon such electrolyte configurations are discussed.

31051 Electrocatalysis of anodic oxygen-transfer reactions at doped lead dioxide. Johnson, D.C. (Dept. of Chemistry, Ames Lab. of the U.S. Dept. of Energy, Iowa State Univ., Ames, IA (US)); Yeo, I.H.; Tang, A.P.C.; Wels, B. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

The anodic oxidation of many compounds by reactions involving transfer of oxygen from water in the solvent to the reaction products is electrocatalyzed at lead dioxide anodes by incorporation of Group VA metal oxides. In many cases, reaction rate constants can be increased by 20-100X or more, frequently becoming mass-transport limited. For example: the oxidation of phenol to benzoquinone is barely perceptible at a lead dioxide anode (β-PbO/sub 2/), prepared by anodic electrodeposition from acidic solution of Pb(II), whereas the reaction is virtually mass-transport limited at Bi-PbO/sub 2/ deposited from an acidic solution containing equal concentrations of Bi(III) with Pb(II). The rutile structure of pure β-PbO/sub 2/is retained for the mixed oxide with only a slight increase in lattice constants. Doping PbO/sub 2/electrodes with Group IIIA metal oxides results in a decrease in rate constant compared to pure β-PbO/sub 2/. It is noted that Bi(V) is thermodynamically stable under the applied potential at the electrode surface and the Bi(V) normally would be considered to have a higher oxide stoichiometry than Pb(IV). Thallium (III), however, normally would have a lower oxide stoichiometry.

31052 Na- and S-activity measurements using glass-membrane reference electrodes/sensors. Bloom, I. (Chemical Technology Div., Argonne National Lab., Argonne, IL (US)); Heiberger, J.; Rea, K.; Redey, L. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

Development of miniature reference electrode systems and designs to measure either sodium or sodium polysulfide activity has continued. The reference electrodes use small (2-mm/sup 2/active area), thin membranes of the Na/sup +/-ion conducting glass which was developed as part of our work on glass electrolytes for Na/S cells. The small, electrochemically active area of the reference electrode makes precise positioning possible in an electrochemical system of interest. As described previously, the reference electrode is made by attaching a thin membrane of ANL Glass (composition, in mol%: 42 Na/sub 2/O, 8 Al/sub 2/O/sub 3/, 5 ZrO/sub 2/, and 45 SiO/sub 2/; resistivity: 221 female cm at 300^{0}C) to a narrow (ca. 3-mm OD), high-density proportional to-Al/sub 2/O/sub 3/tube. Once a reference material is sealed within it, the small active area acts electrochemically like a Luggin capillary tip. However, instead of diffusion-limited or convection mixing of system components, new reference electrode completely isolates the reference material from the rest of the system. Also, the glass-membrane composition can be tailored to the chemistry associated with the particular system.

31053 Fuel cells for extraterrestrial and terrestrial applications. Srinivasan, S. (Center for Electrochemical Systems and Hydrogen Research, Texas A and M Univ., College Station, TX (US)). *Journal of the Electrochemical Society (USA)*, 136(2): 41C-48C (Feb 1989).

The fuel cell is a nineteenth century invention and a twentieth century technology development. Hydrogen-oxygen fuel cell systems have no competition as auxiliary power sources for space vehicles. The alkaline fuel cell system is a proven technology for this application. The solid polymer electrolyte system may be its future competitor. The energy crisis of 1973 stimulated research, development, and demonstration of the phosphoric acid, molten carbonate, solid oxide, and solid polymer electrolyte fuel cell systems using natural gas, petroleum, or coal-derived hydrogen (and carbon monoxide for the high temperature systems) for terrestrial applications. The direct methanol-air fuel cell is still an electrochemist's dream. The present price of crude oil, and the high capital costs and limited lifetime of fuel cell systems impede their terrestrial applications in the developed countries. Conversely, the potential for lower capital costs of labor intensive manufacturing processes and the higher fossil fuel prices make these systems more attractive for such applications in the developing countries.

3008 Miscellaneous Converters

Refer also to citation(s) 30967, 31005

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

Refer also to citation(s) 30950, 30970, 30971, 30994, 31036, 31038, 31682, 33020

31054 (AE/SESR–1989) **Some energy-saving measures for commercial buildings.** Alberta Energy, Edmonton, AB (Canada). Scientific and Engineering Services and Research Div.; Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada). 1989. 12p. (MICROLOG–89-01764). Available from Dept. of Energy, Information Centre, Petroleum Plaza Tower, 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report describes four energy conservation projects in commercial buildings funded by the Alberta/Canada Energy Resources Research Fund. The first is a study of the efficiency of air sealing. It is estimated that $11 M/y could be saved if the larger office buildings in Calgary were retrofitted and sealed. The second project involves computerized building design and energy analysis. An inventory of all the software available in this domain was compiled. The third concerns a ventilation control system based on carbon dioxide levels; the application considered would have had a payback period, in terms of reduced energy costs, of more than five years. The fourth relates to energy savings through direct evaporative cooling instead of chillers; the payback period would be 10 to 12 years, but the implementation of the process throughout southern Alberta is advocated. 2 figs.

31055 (BEST–631U574) **Monitoring of a heat pump heat recovery system.** Pasquini, E. B.E.S.T. Energy Systems, Inc., Oakville, ON (Canada). 1989. 60p. (CE–02617). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The following report describes the design, installation and operation of a heat pump heat recovery system. This system was installed at the University of Waterloo. The system was designed to recover low temperature heat from exhaust fans on the roof, and to upgrade this recovered heat using a heat pump to supply domestic hot water. In two of the exhaust streams, evaporator coils were installed to recover the waste heat. The heat pump refrigerant is pumped from these coils to the suction of the compressor, compressed to a high temperature, high pressure liquid. This liquid then transfers heat to the domestic hot water circulating loop via a shell and tube condenser which provides hot water at about 54/sup 0/C. The refrigerant is then pumped back to the evaporator, and the cycle is repeated. The residence used an average of approximately 28,820 1 of hot water per day, with the heat pump providing approximately 54% of the domestic hot water requirement. To date, the heat pump has operated with an average coefficient of performance of 3.4. Under these conditions, the average daily energy saving would be 562 kWh. This system is not limited to high-rise buidings, but can be adapted for use in all buildings that have a central exhaust and need hot water. 21 figs., 16 tabs.

31056 (BNL–42502) **Cost reduction in absorption chillers: Phase 2.** Leigh, R.W. Brookhaven National Lab., Upton, NY (USA). Feb 1989. 102p. DOE Contract AC02-76CH00016. (GRI–89/0049). Order Number DE89012218/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A research program at Brookhaven National Laboratory (BNL) has addressed the possibility of dramatically lowering the first costs of absorption chillers through lowered material intensity and the use of lower cost materials, primarily in the heat exchangers which make up the bulk of the operating components of these systems. This must be done while retaining the best performance characteristics available today, a gross design point coefficient of performance (COP) of 1.3 and a net design (seasonal) average COP of 1.0 (0.90) in a directly fired, double effect unit. We have investigated several possible routes to these goals, and here report on these findings, focusing on the areas that appear most promising. The candidate technologies include the use of polymer film heat exchangers in several applications, the use of thin strips of new, corrosion resistant alloys to replace thicker, less impervious metals in applications exposed to gas flames, and copper or cupro-nickel foils in contact with system water. The use of such materials is only possible in the context of new heat exchanger and system designs, which are also discussed. To lend focus, we have concentrated on a directly fired double effect system providing capacity only. If successful, these techniques will also find wide applicability in heat pumps, cogeneration systems, solar cooling, heat recovery and chemical process heat transfer. 46 refs., 24 figs., 22 tabs.

31057 (CONF-8809314–) **Mathematical modeling of roof systems.** Oak Ridge National Lab., TN (USA). 1988. 171p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From International symposium on mathematical modeling of roof systems; Oak Ridge, Tennessee, USA; 15-16 Sep 1988. Order Number DE89012907/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

It has been a long hiatus since the first assemblage of roof modelers in November 1981. The Proceedings of that workshop have stood as the only dedicated testament of the attempts to formalize roofing performance into mathematical precepts and formulas. Now, thanks to a strong effort by a very active Organizing Committee, we have an update. The invited papers provide good insight into the status of mathematical modeling. It is clear that modelers are becoming more sophisticated in the way they address the major constituents of a roof – the membrane and the insulation. Bonafont's paper on the visco-elastic properties of bitumen, the comprehensive French membrane model with non-linear coefficients, and the versatile heat transfer model of Wilkes are examples. It is also clear that not much is being done yet with whole roof modeling (i.e, interrelationships between components and combined heat, moisture, and structural analysis.)

31058 (CSST–1988) **Air quality and ventilation in three office buildings.** Goyer, N.; Nguyen, V.H. Commission de la Sante et de la Securite du Travail, Montreal, PQ (Canada). 1988. 14p. (In French). (MICROLOG–89-01358). Available from Institut de recherche en sante et en securite du travail, Direction des communications, 505, boul. de Maisonneuve ouest, Montreal, PQ, Canada H3A 3C2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A research project was carried out whose objects were to identify the sources of air quality problems in office buildings and to propose mechanisms to eliminate or reduce them. Another objective was to validate different techniques and criteria for air quality evaluation. Three sets of factors were considered: air quality as related to chemical contaminants and microbiological agents; comfort parameters; and ventilation system characteristics. A questionnaire survey was also conducted to solicit opinions of building occupants on their perceptions of air quality and ventilation. The actual research was done in three buildings in Quebec; results of air quality evaluations were compared with four different air quality standards. Measurements were made of total dust, formaldehyde, organic compounds, carbon and nitrogen oxides, ozone, and numbers of colonies of bacteria, fungi, and molds. Results are presented in a table and the sources of the contaminants are discussed. The important ventilation parameter of fresh air flow per person was determined by two methods, and the functioning and maintenance of ventilation system components were evaluated and problems noted. Results from the questionnaire indicate that over 70% considered 20-22 degrees C was the most comfortable temperature, over 80% found that the air was too dry, and over 50% found occasional or frequent air currents. It is concluded that the observed air quality was acceptable in view of established standards. Four significant ventilation system problems were also revealed. Recommendations applicable to office buildings in general are listed. 17 refs., 3 tabs.

31059 (DOE/BP/60288–2-Vol.1) **Market study of commercial appliances: Volume 1, Assessment of commercial appliance efficiency improvements: Final report.** Dohrmann, D.R.; Wikler, G.A. ADM Associates, Inc., Sacramento, CA (USA). Mar 1989. 135p. Sponsored by DOE Conservation & Renewable Energy. DOE

Contract AC79-86BP60288. Order Number DE89013093/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The purpose of this report is to assess the market for commercial appliances in the Pacific Northwest and to identify current conservation technologies that can improve the efficiency of cooking equipment, commercial dishwashers, clothes washers and dryers, and water heating systems, and thus provide the region with energy savings. This report describes potentially cost-effective conservation technologies for electric appliances in a number of building types throughout the Pacific Northwest. Also characterized are the dynamics between electric and gas powered appliances. All conservation technologies outlined in this report are currently considered commercially available or will be available within a planning period of less than ten years. Energy savings and cost potential are measured by using Bonneville's supply curve analytical framework. Specific methods and component inputs to the model will be described in later sections of this report. 27 refs., 4 figs., 77 tabs.

31060 (DOE/CE/63522–T1) **A process evaluation of the Iowa partnerships in low-income residential retrofit program.** Iowa Natural Resources Council, Des Moines, IA (USA). [1989]. 15p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG01-86CE63522. Order Number DE89012404/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In August 1986, the Iowa Department of Natural Resources (DNR) was awarded a grant by the US Department of Energy (DOE) to demonstrate to the program entitled "Partnerships in Low-Income Residential Retrofit (PILIRR)". Iowa was one of five states, nationwide, to receive funding for this project. The PILIRR project was designed to expand the affordable rental housing options for low-income Iowans by developing the capacity of five participating community action program agencies (CAA) to leverage investment in weatherization improvements by the owners of rental property occupied by low-priority, weatherization eligible tenants. Weatherization improvements were leveraged through the creation of a $30,000 loan interest buy-down fund available to eligible landlords. The initial goals of the Iowa PILIRR project included: the weatherization of 1,113 units of rental property which were not a priority for assistance under existing state weatherization plan priorities; the leveraging of a total of $500,651 in landlord-financed weatherization improvements, and the solicitation of $50,000 in non-federal monies to replenish the subsidy pool and to fund a statewide expansion of the project. This evaluation report will examine the processes and procedures implemented by the participating CAA agencies and the DNR with respect to the PILIRR project. The report will also recommend improvements to enhance program performance and to give direction to similar future projects. The evaluation report is divided into four sections; Recruitment of CAAs, Financial Mechanisms and Recruitment of Financial Institutions, Program Administration, and Marketing and Program Implementation.

31061 (DOE/ER/60546–4) **The study of neutralization of Po-218 ions by small ion recombination in O_2, Ar and N_2.** Shi, Baolan. Illinois Univ., Urbana, IL (USA). Dept. of Nuclear Engineering. May 1989. 70p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER60546. Order Number DE89013605/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Three mechanisms of neutralization of Po^+, electron transfer, electron scavenging and small ion recombination, have been suggested. Considerable work has been conducted on the first two mechanisms. However, little information about the small ion recombination is available. In the present research, this mechanism was studied by examining the neutralization rates in different radon concentrations in N_2, Ar, and O_2 with the aid of a continuous monitoring of radon and progency experimental system. The results showed that the neutralization rates in the three gases are around 2 to 4 sec^{-1}. A linear relationship between the neutralization rate and the square root of radon concentration was obtained. It was also found that the neutralization rates are higher in the gas with lower ionization potential. The charged fraction of polonium in all cases was measured to be 0.88. Further, the existence of the neutralization rate plateau at high radon concentrations was strongly suggested. 24 refs.

31062 (DOE/ER/60664–1) **Radon generation, adsorption, absorption, and transport in porous media.** Rogers, V.C.; Nielson, K.K.; Merrell, G.B. Rogers and Associates Engineering Corp., Salt Lake City, UT (USA). May 1989. 48p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER60664. Order Number DE89013601/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A unified model of radon emanation, adsorption, absorption, and transport has been developed and incorporated into the RAETRAN code that uses new mathematical models of advective transport, moisture effects, and radon emanation. The model accounts for advective depletion in radon source regions, and for the effects of varying moistures on radon emanation, diffusion, absorption, adsorption, and advective transport rates. Radon transport in gas- and water-filled pore space is characterized, and exchange between the phases is considered. Correlations are also given for diffusion and permeability coefficients. The model provides a comprehensive assessment of source potentials for indoor radon accumulation based on soil moistures, radium, emanation, and advection of soil gas. 10 refs., 10 figs., 1 tab.

31063 (DOE/ID/12584–38) **Validation of the diffusion-barrier charcoal canister method.** Martz, D.E.; George, J.L.; Mamich, S.T.; Langner, G.H. Jr. UNC Geotech, Grand Junction, CO (USA). May 1989. 55p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-86ID12584. (UNC/GJ–47(TMC)). Order Number DE89013339/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A six-month study was conducted by the Technical Measurements Center, US Department of Energy Grand Junction Projects Office, to evaluate the accuracy and reliability of indoor radon measurements using an intermittent diffusion-barrier charcoal canister sampling protocol. Diffusion-barrier charcoal canisters (DBCC) were exposed for seven days in sixteen occupied residences each week during the 26-week study. The radon concentrations measured by the DBCCs were compared to radon concentrations measured by triplicate sets of four different types of alpha-track monitors and integrated hourly radon concentrations measured by a Pylon Model AB-5 continuous radon monitor. The results were also compared with radon-daughter concentrations measured in these same residences by an Eberline WLM-1 working level monitor. Excellent agreement was observed between the integrated mean radon concentrations measured by the DBCCs compared with the six-month alpha-track results, and between the weekly DBCC readings and average weekly radon concentrations measured by the Pylon radon monitors. An intermittent sampling protocol employing six weekly DBCC measurements spaced approximately every two months throughout the year should provide estimates of the average annual indoor radon concentrations that meet the criteria established for the Grand Junction Remedial Action Program. 9 refs., 17 figs., 9 tabs.

31064 (DOE/ID/12584–43) **Development of electret technology to measure indoor radon-daughter concentrations: Final report (Phase 1).** Kotrappa, P.; Dempsey, J.C.; Stieff, L.R. Stieff Research and Development Co., Inc., Kensington, MD (USA). May 1989. 74p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-86ID12584. (UNC/GJ-TMC–5). Order Number DE89013345/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

A new type of radon progeny monitor called an electret radon progeny integrating sampling unit (E-RPISU) was developed and demonstrated which uses an electret ion chamber to measure the progeny concentration. A conventional 1 LPM particulate air sampling system is used to collect the progeny on a 35 cm^2 filter which is mounted on the side of the electret ion chamber such that the collected progeny are exposed to the inside of the chamber. The alpha radiation emitted by the progeny collected on the filter ionizes the air in the 220 ml chamber. The ions of opposite polarity collect on the surface of the 127 μm thick electret and reduce its surface voltage. A specially built surface voltmeter is used to measure the electret voltage before and after sampling. The electret voltage drop which occurs during the sampling period is shown to be proportional to the time integrated progeny concentration. Two prototype systems were fabricated and tested in homes and in calibrated radon chambers. The resulting data are presented and analyzed. The calibration factor for the E-RPISU ranged from 1.5 to 2.0 V/mWL-day depending on the electret voltage. Two of the E-RPISUs were delivered to UNC Geotech for further testing. 32 refs., 11 figs., 5 tabs.

31065 (EI–8311) **Lighting energy conservation from labelling switches - a study. Final report.** Engineering Interface Ltd., Willowdale, ON (Canada). 1983. 73p. (CE–02586). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

This report was designed to determine whether human behaviour in switching lights could be significantly influenced by placing a visual reminder, a switch label, adjacent to the light switch. The potential for reducing the hours of operation of room lights in single person offices using switch off labels next to light switches was investigated. One hundred and fifty-five single person offices in four separate buildings in greater Toronto were measured over a 15 week period. Lighting use was measured on a weekly basis in each office. An experimental design was adopted to measure the effects of the presence or absence of a label. In addition, information was recorded for each office on the presence or absence of daylight, task lighting, and translucent glass panels. A post-experimental questionnaire survey indicated that the majority (62%) of office occupants appreciated the label as a reminder to turn lights off, and 36% did not like the idea. The majority of respondents regarded the label as effective in reducing the hours of light use. Approximately one half of the office occupants felt that the light monitoring device did have some effect on light use. It was concluded that the key to successful energy management use in the office environment lies in understanding, influencing, and controlling human behaviour. 5 refs., 15 figs., 22 tabs.

31066 (EPRI-EM–5842, pp. 237-261) **Market assessment for future technologies.** Blatt, M. Barakat, Howard and Chamberlin, Inc., Oakland, CA (USA). Jul 1988. (CONF-8712119–: Moving toward integrated value-based planning the issues, New Orleans, Louisiana, USA, 1-3 Dec 1987). In *Moving towards integrated value-based planning: The issues.* Order Number DE88016610/JAW. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This paper presents overviews of the markets for commercial-building system energy-using equipment, new electric technology being developed, and the utilities' role in promoting these advanced electric technologies. Two space heating and space cooling examples–water loop heat pumps and high-efficiency electric alternatives to cogeneration–illustrate how the implementation of these advanced electric technologies can provide value to the electric utility by satisfying their load-shaping objectives. The paper then shows what customers value in selecting space-heating and space-cooling equipment, how electric heating and cooling technologies can provide customer value, and what electric utilities can do to enhance and promote the value of these advanced electric technologies to their commercial customers. 15 figures.

31067 (ERATL–89/16/XAB) **Building and energy-management systems: a user guide.** Hawkins, S.A.; Holland, S.I. ERA Technology Ltd., Leatherhead (UK). Aug 1988. 175p. (ERA–87-0175). Available from NTISPC$533.00.

This report contains an introduction to the technology of building and energy management systems and advice on the selection of a system. Dedicated lighting control systems are covered in the report in addition to complete building and energy-management systems. Detailed profiles of UK suppliers are included together with case studies illustrating the use of systems from each supplier.

31068 (LA-UR–89-1059) **Potential benefits of distributed PCM thermal.** Neeper, D.A. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-36. (CONF-890610–2: ASES annual meeting and 14th annual passive solar conference, Denver, Colorado, USA, 19-23 Jun 1989). Order Number DE89009376/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report examines the benefits of passive thermal storage by means of phase change material (PCM) distributed throughout the wall and ceiling surfaces of a building, as would occur if the wallboard were impregnated with PCM. Surface heat transfer is expected to be adequate for thermal storage capacity up to 40-Btu/ft^2 of surface area. Sums of daily energy balances during the heating season indicate that use of PCM-impregnated wallboard with a 40-Btu/ft^2 capacity would provide adequate storage for direct gain systems with the largest practical window area in Denver, Boston, and Fort Worth. It is shown that distributed PCM thermal storage offers the opportunity to obtain several ton-hours of ventilative cooling per night throughout much of the US during July. 17 refs., 9 figs.

31069 (LBL–26587) **Windows and lighting program: FY 1988, annual report.** Lawrence Berkeley Lab., CA (USA). Mar 1989. 21p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE89013357/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Over 30% of all energy used in buildings is attributable to two elements: windows and lighting. Together they account for annual consumer expenditures of over $50 billion. Each affects not only energy use by other major building systems but also comfort and productivity, factors that have a far greater influence on building economics than direct energy consumption alone. Windows play a unique role in the building envelope, physically separating the conditioned space from the world outside without sacrificing vital visual contact. Lighting systems facilitate a variety of tasks with a wide range of visual difficulty throughout the indoor environment while defining the luminous qualities of the indoor environment. These two building elements are thus essential components of any comprehensive building science program. Despite important achievements in reducing building energy consumption over the past decade, significant additional savings are still possible. These will come from two complementary strategies: (1) better building designs that effectively apply existing technology and extend market penetration, and (2) new advanced technologies to increase the savings potential of each application. Both the Windows and Daylighting Group and the Lighting Systems Research Group have made substantial contributions in each of these areas. The ongoing research described in the annual summary aims to further advance achievement of these goals. 15 figs.

31070 (NRC/BR–859) **ENCORE-CANADA. Computer program for the study of energy consumption of residential buildings in Canada.** Konrad, A.; Larsen, B.T. National Research Council of Canada, Ottawa, ON (Canada). Div. of Building Research. 1978. 9p. (CONF-7805256–: Conference on the use of computers for environmental engineering related to buildings, Banff, Canada, 10-12 May 1978;CE–02557). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The paper describes the mathematical methods employed in the ENCORE-CANADA computer program which predicts the hourly as well as the annual heating requirements of small residential-type buildings. ENCORE-CANADA is primarily intended for researchers, designers and consulting engineers interested in energy conservation measures. The model includes the effects of thermal storage, internal heat gains, basement and air infiltration losses, transmission heat losses and solar heat gains. The heating system is a thermostatically controlled oil-fired furnace with warm air distribution. Hourly solar radiation and weather data for various Canadian cities are used to simulate outdoor conditions. 25 refs., 3 figs.

31071 (ORNL/CON–279) **Investigation of metered data analysis methods for commercial and related buildings.** MacDonald, J.M.; Wasserman, D.M. Oak Ridge National Lab., TN (USA). May 1989. 48p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89012800/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This study presents a review and evaluation of techniques for analyzing metered energy use data to determine baseline energy use and potential energy efficiency improvements in commercial and related buildings. A description of new methods that should be considered in such work is also presented. Development of relationships between energy characteristics and building physical characteristics is seen as an important area for improvement of analysis methods. Knowledge of the causes of variations in energy use and the expected relative impacts of different schedules, functional uses, and energy systems should be upgrades to allow adequate understanding of efficiency changes and better exchanges of efficiency improvement results. Significant advancements in analysis approaches for metered data from commercial buildings are being tested, and further improvements are needed. The improvements should include continued development of multiple parameter

methods, development of methods for analyzing more detailed data, use of macrodynamic methods to generate models with physical significance, and simplification of the methods. The recommendations of this study are to begin research on advanced analysis methods, to develop a coordinated research program on analysis methods, to develop a classification method to define analysis approaches and promote the use of the method for reporting energy analyses, to extend analyses of energy efficiency improvements to characterize building types, and to classify packages of common efficiency improvements technologies or approaches appropriate to the different building types. 48 refs., 7 figs.

31072 (ORNL/M–329/R1) **The Roof Research Center: A national user facility for thermal performance and durability of roofing systems: Users manual.** Oak Ridge National Lab., TN (USA). 21 Apr 1989. 21p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89012797/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Users Manual provides roofing industry managers unfamiliar with the concept of a National User Facility with a brief background on the capabilities of the Roof Research Center, along with some details on how a user facility operates. This information will be widely circulated in an attempt to provide potential users with an opportunity to be aware and take advantage of the capabilities at the Center. 8 figs.

31073 (PB–89-167464/XAB) **Development and field test of a desiccant-based air conditioning system for supermarkets. Final report, October 1983-May 1988.** Bowlen, K.L.; Manley, D.L.; Calton, D.S. Cargocaire Engineering Corp., Amesbury, MA (USA). Sep 1988. 86p. Available from NTIS, PC A05/MF A01.

The supermarket HVAC market was characterized, and a desiccant-based system was developed to meet the requirements of the characterization. Two systems were field tested and the potential of further operating savings was quantified. These are extension of the time interval between defrosting the refrigerated food cases and controlling the supply air volume proportional to the load requirements. Energy cost savings by the use of gas instead of electricity for the latent heat portion of the load, more-efficient operation of the refrigerated food cases due to less frost and reduced supply air volume are quantified. This development work and testing has initiated market acceptance of use of gas-fired desiccant-based air conditioning systems. Thirty supermarket chains are now using these systems.

31074 (PB–89-173645/XAB) **Gas-engine heat-pump system and component efficiency and reliability improvement. Phase 2 report, September 1986-January 1989.** Jakob, F.E.; Brown, V. Battelle Columbus Div., OH (USA). Jan 1989. 67p. (N–4577-2501). Available from NTIS, PC A04/MF A01.

See also PB–87-176335.

The Gas Research Institute is directing several research projects to develop gas-fired heat pumps for residential and light commercial use. The project work described in the report identifies and evaluates potential improvements in the cycle and key components of these heat pumps and provides short- and long-term inputs for the heat-pump product-development efforts. Principal results of Phase II studies under the project are: compressors for commercialized gas-engine heat pumps (GEHPs), auxiliary heat recommendations for GEHPs, rotary engine test data, duty-cycle test stands, and heat-pump design specifications.

31075 (PNL–6849) **Evaluation of DOE's Partnership in Low-Income Residential Retrofit (PILIRR) Program.** Callaway, J.W.; Lee, A.D. Pacific Northwest Lab., Richland, WA (USA). May 1989. 163p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE89012822/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

In July 1986, the US Department of Energy (DOE) awarded competitive grants to five states to conduct pilot projects to establish partnerships and use resource leveraging to stimulate support for low-income residential energy retrofits. The projects were conducted under DOE's Partnerships in Low-Income Residential Retrofit (PILIRR) Program. These projects have been monitored and analyzed through a concurrent process evaluation conducted by the Pacific Northwest Laboratory (PNL). This study reports the findings of that evaluation. The overriding goal of the PILIRR Program was to determine whether the states could stimulate support for low-income residential energy improvements from non-federal sources. The goal for the process evaluation was to conduct an assessment of the processes used by the states and the extent to which they successfully established partnerships and leveraged resources. Five states were selected to participate in the program: Florida, Iowa, Kentucky, Oklahoma and Washington. Each state proposed a different approach to promote non-federal support for low-income residential weatherization. Three of the five states–Florida, Iowa, and Washington–established partnerships that led to retrofits during the monitoring period (October 1986–October 1988). Kentucky established its partnership during the monitoring period, but did not accomplish its retrofits until after monitoring was complete. Oklahoma completed development of its marketing program and had begun marketing efforts by the end of the monitoring period. 16 refs., 7 figs., 1 tab.

31076 (PW–87-8) **Comparative performance of fluorescent iron-core ballasts and electronic ballasts.** Pasini, I. Public Works Canada, Ottawa, ON (Canada). 1987. 84p. (In English and French). (MICROLOG–89-01718). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Commercially available one- and two-lamp fluorescent luminaires were tested, and a number of electrical parameters were measured using varying combinations of lamps and either iron-core or electronic ballasts. Comprehensive photometric tests and thermal measurements were also conducted. The test results were tabulated and compared. The performance of the iron-core ballasts was found to be sufficiently close to nominally rated values to not raise concerns. Results from testing the electronic ballasts showed that the user has to be careful when selecting these ballasts, as they far exceed standard specification limits for current and voltage crest factors. All other electrical, photometric and thermal parameters are within accepted levels. An economic analysis was undertaken to determine cost benefits and payback periods for using electronic ballasts, the use of which will result in higher efficiency and lower power consumption. A project life of 20 years was assumed, and analysis was run for a power cost of $0.04/kWh. A unit made by Fyrnetics showed the lowest total annual owning and operating costs and had a payback period of 12.1 years. 13 figs., 13 tabs.

31077 (PW–87-9) **Performance evaluation of 3M Silverflux retrofit reflectors.** Pasini, I. Public Works Canada, Ottawa, ON (Canada). 1987. 78p. (In English and French). (MICROLOG–89-01821). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Super-reflective retrofit reflectors have been reported to produce large increases in luminaire efficiency. The electrical, thermal, photometric and economic performance of such a reflector was tested as installed in a commercial fluorescent luminaire. Super-reflective reflectors use pure silver deposited on a thin plastic film, which is then bonded to the metal reflector surface. The front-reflective type, in which the reflective layer is on the outside, was chosen for testing, and the 3M Silverlux was selected as being representative of this type. The performance of this reflector was found to be reasonably good, offering increased luminaire efficiencies of about 33% and a payback period of less than 5 years at 7 cents/kWh energy costs. If retrofit reflectors are used to lengthen the life of the lighting installation, payback can be shortened considerably. 2 refs., 5 figs., 20 tabs.

31078 (PW–C1) **Environmental and energy performance.** Jaeggin, K. Public Works Canada, Ottawa, ON (Canada). 1988. 64p. (In English and French). (MICROLOG–89-01910). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A total performance approach is presented for evaluation of buildings. Available methods for environmental and energy performance evaluation are also described, including an outline of performance requirements. The application of these methods in an evaluation project, and in solving the building performance problems as they arise, is discussed. Environmental and energy performance addresses five of the seven total building performance attributes: thermal quality, acoustic quality, air quality, visual quality, and energy effectiveness. The physical conditions of the environment at the work station and in the building spaces in relation to user requirements and activities are covered in the evaluation process. Environmental performance indices and criteria that help define the factors that influence the indoor environment are given. The total performance approach includes an energy effectiveness evaluation for minimizing energy use and life-cycle costs without adversely affecting other aspects of total building performance.

31079 (PW–C2) **Functional performance.** Chow, M. Public Works Canada, Ottawa, ON (Canada). 1988. 83p. (In English and French). (MICROLOG–89-01917). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Functional performance, as applied to evaluation of buildings, is the study of people-environment relationships. Its ultimate goal is to determine the most effective and efficient relationships between building, environment, people and activities. This document provides a brief theoretical background and description of methods for evaluating functional performance. An overview of user needs and requirements is given, while defining appropriate functional and spatial conditions to support these needs and requirements. The user qualities identified in a functional evaluation are essential for any assessment of total building performance. Their application provides the context for many of the evaluations conducted by environmental, energy, and systems performance disciplines.

31080 (PW–C3) **Systems and material performance.** Jaeggin, K. Public Works Canada, Ottawa, ON (Canada). 1988. 92p. (In English and French). (MICROLOG–89-01931). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document describes the impact of materials, components and systems on the total performance approach to building evaluation. The relationship of systems and materials performance to other performance areas, and to distinct phases of the project delivery process is explained. Building systems are listed with descriptions of the factors that affect their performance. Such systems include heating, ventilating, air conditioning, and lighting. A general approach to testing of systems and components is outlined, and a method for carrying out evaluations is given. An extensive list of systems, sub-systems and qualities to be tested is included and is cross-referenced to a bibliography of test methods and standards. 173 refs.

31081 (PW–D01) **Pollutant evaluation.** Kerr, G. Public Works Canada, Ottawa, ON (Canada). 1988. 197p. (In English and French). (MICROLOG–89-01926). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document outlines the causes of pollution of ambient air in conditioned environments, and the problems associated with each of the pollutants. A description of the different levels of testing involved in a building evaluation is included, from unequipped observation to the use of complex measurement devices. Accompanying each test description is a list of applicable air quality standards and guidelines. There is an extensive bibliography. The pollutants covered are carbon dioxide, carbon monoxide, formaldehyde, particulates, radon, volatile organic compounds, and biological materials. The sources of each pollutant and the areas they most commonly affect are outlined in order to provide a starting point for an inspection. A general understanding of the measurement methods and assessment procedures in evaluating air pollution in buildings is given. Includes glossary. 36 refs., 16 figs., 7 tabs.

31082 (PW–D04) **Global evaluation. Energy performance.** Jones, L. Public Works Canada, Ottawa, ON (Canada). 1988. 58p. (In English and French). (MICROLOG–89-01916). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document describes the first step in assessing energy performance of a building, showing how potential energy conservation can be recognized and used. A description of energy budgets, and how they are made, is given. The procedures show how to assess a building's energy consumption and determine how much of that energy is wasted. To evaluate energy efficiency, a building's energy consumption can be compared to its energy budget, or the energy consumption of similar buildings. The evaluation can include searching for energy inefficiency indicators as listed, or studying year to year trends. The methods described include normalization of dissimilar factors (such as weather), size of building, and occupant activity. Methods of comparing the energy content of different sources are explained. 7 refs., 3 figs., 1 tab.

31083 (PW–D06) **Equipment and systems evaluation. Energy performance.** Jones, L. Public Works Canada, Ottawa, ON (Canada). 1988. V (In English and French). (MICROLOG–89-01921). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The implementation of energy conservation opportunities in the use of a building's equipment and systems while maintaining suitable environmental conditions contributes to energy effectiveness. Numerous factors contribute to ineffective use of energy. These factors transcend the disciplines traditionally involved in building design and evaluation and they impact on one another. They include poor envelope systems, inefficient lighting, and wasteful mechanical systems. This document outlines the evaluation process as done by transdisciplinary specialists. The evaluation starts with a preliminary assessment and progresses through subsequent stages, gradually increasing the detail of the evaluations but reducing the scope. Equipment and systems are evaluated through review of specifications and operating procedures, by inspection and testing, and to a limited extent by functional analysis. 1 tab.

31084 (PW–D09) **Air circulation evaluation.** Public Works Canada, Ottawa, ON (Canada). 1988. 84p. (In English and French). (MICROLOG–89-01908). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Methods of assessing air circulation patterns in office buildings are described for three stages of investigation, from preliminary assessment using smoke pencils to in-depth investigation using full imaging infrared systems. Procedures are given for tracing local air flow patterns around workstations as well as large scale circulation patterns in open office areas. Equipment required is listed, limitations of the techniques are discussed and background information is included. 5 refs., 3 figs., 1 tab.

31085 (PW–D10) **Illumination evaluation.** Pasini, I. Public Works Canada, Ottawa, ON (Canada). 1988. 207p. (In French). (MICROLOG–89-01920). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document provides methods for assessing the illuminated environment of office buildings. Interiors, exteriors, electric lighting, and daylighting are all discussed along with techniques given for their analysis. The three stages of assessment described are

discussed in terms of both quantity and quality issues. Issues addressed include: light source efficacy, reflectance and transmittance of materials, luminance and illuminance surveys, daylighting issues and surveys, contrast, visual performance, lighting control strategies, maintenance, video display terminal areas, energy audits, photometric data, laboratory testing, and emergency lighting. The appendices contain detailed survey methods, along with examples and reference tables. A glossary is also included. 10 refs., 43 figs., 46 tabs.

31086 (PW–D33) **Mechanical systems evaluation.** Brown, W.A. Public Works Canada, Ottawa, ON (Canada). 1988. 61p. (In English and French). (MICROLOG–89-01913). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document establishes an analytical procedure for the performance evaluation of mechanical systems in occupied buildings. Such systems include heating, ventilation, air conditioning, fire protection, and plumbing. The procedure assists with this evaluation process by providing a defined and subjective assessment method for a wide range of building types and occupational usages. Evaluation focuses on internal environment, suitability and convenience of the facilities, safety, and operation and maintenance experience and associated costs. Assessment is broken down into three stages: a preliminary assessment and observation of the mechanical system during a walk-through; a further analysis of the problem using simple measurement techniques carried out by building technicians; and an in-depth analysis of performance problems carried out by a team of professionals resulting in definitive recommendations.

31087 (PW–D34) **Mechanical controls evaluation.** Public Works Canada, Ottawa, ON (Canada). 1988. 70p. (In English and French). (MICROLOG–89-01915). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document aids in operating a building in an efficient and economical manner. It helps a professional or technician with limited experience in heating, ventilating, and air conditioning (HVAC) control systems to balance the two major dynamic components present in a building: the needs of the occupants and the desire for minimized operating costs. The document includes a staged evaluation of a HVAC control system for a building 3,000 m/sup 2/or less. The evaluation starts with a preliminary assessment, followed by simple measurement techniques, and concludes with specialized in-depth monitoring. The appendices contain detailed information on maintenance and problem solving, and an introduction to HVAC control diagrams. 14 refs., 5 figs.

31088 (PW–D35) **Electrical systems evaluation.** Public Works Canada, Ottawa, ON (Canada). 1988. 90p. (In English and French). (MICROLOG–89-01909). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document describes procedures for assessing a building's electrical system. The testing and monitoring methods given are for optimizing both safety and economy. Check lists for the components of electrical systems are provided. The examination procedures described are for an emergency generator test, a fire alarm system test, infrared testing, voltage drop, and power factor measurement. Specialized in-depth monitoring is used to check system coordination and system transient phenomena. The assessment includes evaluation of utility rates and the demand charge, and of the power factor and its impact on utility bills. Sample utility bill calculations are provided to illustrate common billing procedures. Examples of eight systems and recommended wiring methods are included. 9 figs.

31089 (PW–D41) **Roofing systems evaluation.** Public Works Canada, Ottawa, ON (Canada). 1988. V (In English and French). (MICROLOG–89-01923). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Roofing systems are constantly under attack from the environment: few other building assemblies are exposed to conditions as harsh during their service life. To minimize deterioration, the roofing materials have to be suitably resistant or protected, and their design and their installation are important. A periodic inspection should take place to identify and repair potential problem areas before the deterioration progresses too far. Information on inspection, evaluation, and maintenance planning techniques for low-slope roofs are provided in this report. Components of the roofing systems examined include membranes, thermal insulation, vapor barriers, and parapet walls. Other information related to roofing systems and materials in use today is also given in order to obtain a proper understanding of their behaviour. 27 refs., 2 tabs.

31090 (PW–DO7) **Retrofit evaluation. Energy performance.** Jones, L. Public Works Canada, Ottawa, ON (Canada). 1988. 98p. (In English and French). (MICROLOG–89-01922). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Defining a logical and cost effective plan for retrofitting contributes significantly to the overall energy effectiveness evaluation when modifying buildings, physical characteristics. The retrofit process is concerned with the following stages: calculating direct and indirect energy savings; estimating capital cost; analyzing the cost benefit; and evaluating the possible impact of retrofit on the performance of other building components and systems. This is done by providing a catalogue of interactions between building systems. This document describes the methods of analysis and the techniques involved at three stages of evaluation. Knowledge of the differences and limitations of the basic calculation methods is considered, including the level of detail, and the sensitivity and accuracy of the methods available. This evaluation can be made using hand calculation techniques and computer models to predict the building components' energy consumption. 11 refs.

31091 (SERI/TP–254-3049) **Development of a second-generation, video-based luminance mapper for daylighting research.** Weaver, N.L.; Robbins, C.L.; Hunter, K.C.; Cannon, T.W. Solar Energy Research Inst., Golden, CO (USA). Nov 1988. 11p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-861109–9: 2. international daylighting conference: architecture and natural light, Long Beach, California, USA, 5-7 Nov 1986). Order Number DE89000850/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Quantitative mapping of sky or room luminance distributions is a technically challenging endeavor. Several approaches have been developed based on using photometric or photographic techniques. Video-based imaging photometry has the demonstrated capability to generate luminance distribution data for both the sky dome and interior spaces. This paper discusses a new microcomputer/solid-state camera-based system with expanded graphic and high-speed data manipulation capabilities. The focus of the paper is a discussion of preliminary calibration specifications for the system and applications. 9 refs., 9 figs., 2 tabs.

31092 (SERI/TP–254-3478) **Testing of novel desiccant materials and dehumidifier matrices for desiccant cooling applications.** Pesaran, A.A.; Bingham, C.E. Solar Energy Research Inst., Golden, CO (USA). Mar 1989. 14p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-890609–3: ASHRAE annual meeting, Vancouver, Canada, 24-28 Jun 1989). Order Number DE89000875/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents the results of testing of desiccant materials and dehumidifier matrices for desiccant cooling and dehumidification applications. In testing desiccant materials, we used a gravimetric technique to measure the moisture capacity of four desiccant materials. These materials were microporous silica gel powder, macroporous silica gel powder, polystyrene sulfonic acid sodium salt, and a silica-gel/epoxy composite. The microporous silica gel powder had the most desirable moisture capacity properties of the four materials tested for desiccant cooling applications. The

polystyrene sulfonic acid sodium salt showed some promise. Our testing of dehumidifier matrices included measuring the pressure drop and heat- and mass-transfer rate characteristics of a silica-gel/corrugated dehumidifier matrix under conditions typical of desiccant cooling systems. The matrix is a section of a commercial dehumidifier. The transient dehumidification capacity of the matrix was calculated from the tests and compared with previously tested matrices. 9 refs., 10 figs., 2 tabs.

31093 (UCID–20717-Rev.1) **Ventilation survey manual: Revision 1.** Miller, G. Lawrence Livermore National Lab., CA (USA). May 1989. 44p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012256/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This manual is written for Health and Safety Technicians at the Lawrence Livermore National Laboratory (LLNL). The objective of this manual is to assure that ventilation systems are thoroughly evaluated in a consistent manner throughout the life spans of the systems. Through lecture and practical experience, Industrial Hygienists train Technicians to evaluate ventilation systems. This manual should be used as a reference by trained Technicians in their independent surveys of ventilation systems. There is a surprising amount of turmoil in the field of industrial ventilation. The criteria for defining the acceptable velocities of air entering through the pass-out doors of glove boxes, for example, are under review at this time. In addition, the microchip revolution has led to a number of instruments with digital read-out displays and one instrument with a data logger. Future instruments may have both analog and digital displays and the ability to make real-time calibrations. Thus, this manual will need to be revised periodically to keep up with changes in theory and technology. 10 refs., 16 figs., 2 tabs.

31094 (UCRL–100878) **Assessing tap-water contributions to inhalation exposure for volatile organic chemicals.** McKone, T.E.; Knezovich, J.P. Lawrence Livermore National Lab., CA (USA). 3 May 1989. 15p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890692–10: 82. Air and Waste Management Association annual meeting and exhibition, Anaheim, California, USA, 25-30 Jun 1989). Order Number DE89012369/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

For many years the only mechanisms of contaminant uptake considered in the development of drinking-water standards were the consumption of water and ingestion of fish. However, efforts to assess human exposure to contaminated tap water have revealed that significant exposures to volatile organic compounds (VOCs) can occur from pathways other than ingestion. Several researchers have investigated the relative importance of a variety of VOC exposure routes in the home from use of contaminated water supplied. In addition there have been studies of the contribution to indoor radon exposure as a result of waterborn radon-222, another highly volatile substance. These studies indicate that exposure to volatile chemicals in tap water by inhalation may be as large or larger than exposure from fluid ingestion. The contaminants available in the indoor air are mobilized by showers, baths, toilets, dishwaters, washing machines, and cooking. In this paper, we summarized the model we use for simulating indoor concentrations of VOCs from household water use. We then describe a series of experiments we are using to verify this model for several VOCs. These experiments are full-scale studies of contaminant transport in an actual house (not a laboratory mock-up) that has been replumbed and instrumented for these studies. 14 refs., 2 figs., 3 tabs.

31095 Comprehensive room transfer functions for efficient calculation of the transient heat transfer processes in buildings. Seem, J. E. (Solar Energy Laboratory, University of Wisconsin-Madison, Madison, WI 53706(US)); Klein, S. A.; Beckman, W. A.; Mitchell, J. W. *Journal of Heat Transfer (USA)*, 111(2): 264-273 (May 1989).

This paper describes a method in which the transfer functions describingheat flow in building elements can be combined into a single tranfer functionfor an enclosure, referred to as a comprehensive room transfer function (CRTF).The method accurately models longwave radiation exchange and convection in anenclosure through an approximate network, referred to as the "star" network.Resistances in the star network are determined from a network that uses viewfactors to model long-wave radiation exchange. The Pade approximation andbilinear transformation are used to reduce the number of coefficients in a CRTF.

3202 Transportation

Refer also to citation(s) 30773, 30774, 31154, 31593, 31916

31096 (MU/CRT–8706) **A computer system for the design and experimentation of routing algorithms.** Potrin, J.-Y.; Lapalme, G.; Rousseau, J.-M. Montreal Univ., PQ (Canada). Centre de Recherche sur les Transports. 1987. 40p. (MICROLOG–89-01232). Available from Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, PQ, Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The computer system ALTO was designed to facilitate the development and experimentation of routing algorithms for transportation vehicles. This system, implementated on the 1108 Xerox Lisp Machine, embodies a set of templates, known as the general heuristic, which is applied to specific situations by an expert user with his own formulae. In this way, ALTA can be used to reproduce a broad class of classical routing algorithms already described in the literature, or can be used to devise new resolution strategies in the face of complex problems. A real application for a mail pick-up problem is presented at the end of the paper, in order to emphasize the benefits of the system. In this application, ALTO produced a mail route design 10% shorter than using a specialized algorithm that had previously been proven superior to manual route-building methods. 12 refs., 21 figs.

31097 (PB–89-158448/XAB) **Training manual for methanol-fuel use in transit operations.** Murphy, M.; Pine, R.C. Battelle Columbus Div., OH (USA). Jul 1988. 39p. Available from NTIS, PC A03/MF A01.

This manual is on the handling and use of methanol fuel in transit operations. It was prepared in support of the UMTA Methanol Bus Program. The manual is designed for use by transit personnel involved in the operation, servicing, and maintenance of methanol-fueled buses. The purpose of the manual is to answer questions about methanol, describe some of the methanol properties, and explain the important safety factors related to transit use. A companion audio-visual slide-tape program was developed that reviews and reinforces the material in the manual. The manual contents are directed toward M-100 or neat methanol because it is the methanol fuel composition that has gained greatest acceptance as fuel for heavy-duty engines. The material in the manual is basic, charted-out clearly, and easily understood. The manual is important to agencies using or preparing to use methanol fuel in transit.

31098 (PB–89-158455/XAB) **Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988.** Francis, G.A.; King, R.D. Battelle Columbus Div., OH (USA). Oct 1988. 94p. Available from NTIS, PC A05/MF A01.

See also PB–89-158448.

The UMTA Methanol Bus Demonstration Program was established to develop information concerning safety, cost of ownership, maintainability, public health, and reliability issues arising from the operation of methanol-fueled transit buses. The report is the first of a series of proving-ground comparisons of methanol demonstration and diesel-control transit buses. The tests included cold and warm weather tests of three methanol-fueled and three diesel-fueled M.A.N. transit buses taken from revenue service at Seattle Metro, Washington. Three methanol test buses from the demonstration fleet and three diesel control buses were compared under carefully controlled proving-ground conditions. Buses were tested for driveability, acceleration and gradeability, and noise. It is recommended that the methanol-demonstration proving-ground comparisons of methanol and diesel buses be continued, tests be performed with buses by other manufacturers, and that future comparative testing be limited to buses and engines available to bus purchasers on a current basis.

31099 (PB–89-160089/XAB) **Analysis of four selected state-transportation coordinated efforts in social services and rural**

public transportation. Final report. Prater, G.S.; Alexander, M.; Williams, R.M. Jackson State Univ., MS (USA). Mar 1989. 125p. Available from NTIS, PC A06/MF A01.

This research proposed to improve the coordination of specialized transit systems by documenting different systems that have worked effectively as well as deciphering any gaps in management and operations in these selected systems. The study was an analysis of four states' coordination of specialized and rural public transportation services as defined by Section 16(b)(2) and Section 18 of the Urban Mass Transportation Act of 1964, as amended. The four states that comprised the study were North Carolina, South Carolina, Florida and Mississippi. The study explored issues related to barriers, transportation organizations, technical assistance, coordinated transportation, evaluation measures, performance and effectiveness measures, experience and training of agency directors and operating practices. Perceived barriers to coordination efforts identified by State Departments of Transportation and Health and Human Services respondents included: differences in funding regulations, physical and geographical differences, differences in management style and in clientele needs. Barriers noted by providers included cost of liability insurance, administrative policy, and clientele needs.

31100 (PB–89-160238/XAB) **Commuter, regional, and rail transit: research and analysis. Transportation Research Record.** National Research Council, Washington, DC (USA). Transportation Research Board. 1988. 66p. (TRB/TRR–1162). Available from NTIS, PC A04/MF A01.

Library of Congress catalog card no. 88-28398.

The 7 papers in this report deal with the following areas: evaluating the accessibility of commuter rail services: metro systemwide parking inventory/assessment; railrider - a comprehensive commuter rail forecasting mode; development of a rail-station choice model for NJ transit; characteristics of metro networks and methodology for their evaluation; attitudes and practices: direct-current transit systems and stray-current corrosion; Hoboken terminal: pedestrian planning for the twenty-first century; and staging-area simulation model for Seattle metro bus subway.

31101 (PB–89-160246/XAB) **Transit management and replacement capital planning. Transportation research record.** National Research Council, Washington, DC (USA). Transportation Research Board. 1988. 132p. (TRB/TRR–1165). Available from NTIS, PC A07/MF A01.

Library of Congress catalog card no. 88-34477.

The 15 papers in this report deal with the following areas: planning priorities for replacement of transit assets; establishing a transit capital replacement account - the San Diego experience; use of life-cycle cost analysis in transit capital overhaul/replace decisions - an application to the PATH railcar fleet; methodology for projecting rail transit rehabilitation and replacement-capital financing needs; long-range transit fleet planning: defining and costing a replacement-only scenario for Seattle; strategic planning as a basis for capital-investment programming: case study of the regional transportation authority in Chicago; trolley bus and motor-coach operational cost comparisons utilizing section 15 data; strategic model for operator work-force planning in the transit industry; monitoring performance of new bus routes; optimization strategies for transit systems in urban corridors; data processing software for an automatic data-acquisition system in mass transit; determinants of superior performance in public transit: research opportunities using Section 15 data; life-cycle cost analysis of electronic registering fareboxes: a case study; cluster-sampling techniques for estimating transit patronage; recent changes in BART patronage: some findings on fare elasticities.

31102 (PB–89-160253/XAB) **Issues in environmental analysis. Transportation Research Record.** National Research Council, Washington, DC (USA). Transportation Research Board. 1988. 39p. (TRB/TRR–1166). Available from NTIS, PC A03/MF A01.

Library of Congress catalog card no. 88-39337.

The 4 papers in this report deal with the following areas: identification and ranking of environmental impacts associated with the United States interstate highway system; effectiveness of mitigation techniques at the Alafia River crossing; managing pollution from highway storm-water runoff; and planning urban access for large combination trucks.

31103 (PB–89-160261/XAB) **Transportation planning and automated guideways. Transportation research record.** National Research Council, Washington, DC (USA). Transportation Research Board. 1988. 67p. (TRB/TRR–1167). Available from NTIS, PC A04/MF A01.

Library of Congress catalog card no. 88-32951.

The 8 papers in this report deal with the following areas: Green River Valley transportation action plan: the development of a successful interjurisdictional road-improvement plan; public-involvement process for identifying problems and alternative solutions for the Year 2010 transportation plan; Miami-downtown people mover demand analysis model; traffic-modeling techniques for the developing world: case studies; some issues in transport planning for third world cities; use of models by french consultants for urban transport planning in developing countries; stepwise regression model of development at nonmetropolitan interchanges; transport in rural areas of developing countries: empirical findings from Western Province, Zambia.

31104 (PB–89-163505/XAB) **Energetic approach towards affordable transportation.** Uken, E.A. Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research. 1987. 14p. (CSIR-RR–494). Available from NTIS, PC EE04/MF E04.

Summary in Afrikaans. Pub. in Proceedings of the Annual Transportation Convention (ATC 1987), Vol. 4C paper 4C/III, 11p(Aug 1987). North American Continent sales only.

An attempt is made to show how transportation costs may be reduced by using liquid fuel more efficiently. Aspects concentrated on include trip rationalization; route choice; the efficiency of the engine and vehicle; and judicious driving. Tables are presented to quantify the possible savings due to these parameters. It is concluded that significant cost savings can be brought about by simply changing attitudes and behavior patterns.

31105 (PB–89-163554/XAB) **Combi-taxi: past, present, and future.** Freeman, M.; Ngcoya, J.; Chapman, J. Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research. 1987. 21p. (CSIR-RR–501). Available from NTIS, PC EE04/MF E04.

Summary in Afrikaans. Pub. in Proceedings of the Annual Transportation Convention (ATC 1987), Vol. 3C, paper 3C/IV, 18p(Aug 1987). North American Continent sales only.

The emergence of the combi-taxi as a form of public transport has been controversial. The proposal to immediately deregulate the combi-taxi market, contained in the White Paper on national transport policy, has created further debate. Policy proposals with regard to the future of the combi-taxi, as seen by the Southern African Bus and Taxi Association (SABTA), are presented in this paper with a view to suggesting means of smoothing the transition period during which change will take place.

3203 Industry and Agriculture

Refer also to citation(s) 30781, 30782, 30993, 31137, 31580, 31901, 31999

31106 (AFME–FR.17) **Proceedings of the France - Korea 2. Joint Seminar on energy conservation vol. 1 et 2.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris. 1986. 512p. (CONF-8609472–: France - Korea - 2. joint seminar on energy conservation, Seoul, Republic of Korea, 11-12 Sep 1986). Order Number DE89764081/JAW. Available from NTIS (US Sales Only), PC A22/MF A01.

The main topics of the symposium are: energy conservation policy in Korea, energy management in the agricultural products and food sector in France, energy savings in sugar refining process and in a milk plant, energy management using a heat pump in a canning plant, methodology and goals in industrial energy audits, gas technology in the food industry, energy savings with gas in greenhouse cultivation, in textile industry, in metallurgical processes and in paper industry, waste heat recovery, fluidized bed combustion using korean low grade anthracite, use of infrared thermography for industrial energy audits.

31107 (DOE/BP/39166–2) **The role of electricity in Pacific Northwest irrigated agriculture: Volume 2, Background materials and support documents: Sections A–C.** USDOE Bonneville Power Administration, Portland, OR (USA); Northwest Economic Associates, Vancouver, WA (USA). May 1989. 165p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC79-88BP39166. Order Number DE89013081/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This document contains background material related to Volume 1. The contents are: background material and selected data tables for agricultural production in the Pacific Northwest; theoretical review of irrigation electricity demand; and economic model specifications and statistical results.

31108 (DOE/BP/39166–3) **The role of electricity in Pacific Northwest irrigated agriculture: Volume 2, Background materials and support documents: Sections D–G.** Northwest Economic Associates, Vancouver, WA (USA). May 1989. 215p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC79-88BP39166. Order Number DE89013079/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This document contains background material related to Volume I. The contents are: linear programming model description and results; background materials for wholesale irrigation rate targeting/impacts of the BPA irrigation rate discounts; situation/outlook for Pacific Northwest irrigated agriculture; and irrigation survey.

31109 (DOE/CH/10093–31) **Programs in energy conservation: Industrial programs.** Solar Energy Research Inst., Golden, CO (USA). Dec 1988. 17p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000803/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In an era of uncertain energy costs, oil import-driven trade deficits, and intense international competition in industrial markets, leadership in the development and use of energy-conservative technologies is vital to the well-being of US industry. The Industrial Energy Conservation Program, managed by the Office of Industrial Programs (OIP) of the US Department of Energy (DOE), supports research and development (R and D) to improve the energy efficiency of industrial processes and to develop technologies that use multiple types of fuels. In pursuing these primary objectives, the program also advances US technological leadership and enhances US industry's competitive position. The program communicates information on emerging technologies widely and promptly throughout industry. The challenge addressed by the program is broad. Industry's share of national energy consumption currently amounts to 36%. This energy is used in a wide variety of combustion applications, chemical reaction and electrolytic processers, and direct motor-drive applications. Many of these processes have energy efficiencies far below theoretical limits and substantially lower than the efficiencies of competing processes in other countries. An improvement of only 1% in the rate of industrial energy use would save about 0.3 quad (one quad is a thousand trillion Btu) per year, worth about $1 billion.

31110 (EGG-M–88355) **Fiber optic sensing for NDE and process control.** Smith, J.A.; Johnson, J.A.; Carlson, N.M.; Barna, B.A. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 6p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-8905107–3: SEM spring meeting, Cambridge, Massachusetts, USA, 28 May - 2 jun 1989). Order Number DE89010976/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Many optical techniques are being developed for the inspection of completed parts and for the sensing of manufacturing processes as part of process control schemes. Optical techniques are attractive because of their noncontacting nature and their ability to obtain information from a hazardous environment. However, many of these techniques currently require delicate alignment and calibration, which make them impractical outside the laboratory. In addition, the methods themselves may be hazardous if beams of high intensity laser light are used in the sensing process. The application of fiber optics to laser sensing techniques has the potential to make them more practical and safer in an industrial environment. This paper discusses three optical techniques which use fiber-optic technology to make then more robust and safe. The first uses fibers to deliver pulse laser light for a vision system which is capable of viewing high luminosity processes. The second also uses fibers to deliver pulsed laser light, but for the purpose of generating ultrasound in a region where a normal ultrasonic transducer could not be used. The third application uses fibers in the arms of a heterodyne interferometer which can be used to detect vibrations or ultrasonic waves. 12 refs., 6 figs.

31111 (EMR/MS–87-6E) **Fly ash in concrete. Compilation of abstracts of papers from recent international conferences and symposia on fly ash in concrete.** Sivasundaram, V.; Malhotra, V.M. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Mineral Sciences Labs. 1986. 86p. (MICROLOG–89-01610). Available from Dept. of Regional Industrial Expansion, Public Information Branch, 235 Queen St., Ottawa, ON, Canada K1A 0H5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Fly ash, a byproduct of a number of industries, is used in concrete to help impart special properties and reduce cement requirements. Use of fly ash also helps to solve problems related to disposal of solid wastes. Abstracts of papers from recent international conferences on the use of fly ash in concrete were selected for this compilation on the basis of their direct relevance to the practical application of fly ash to concrete construction. The abstracts are presented in chronological order, and are from 13 conferences held from 1980 to 1986 inclusive. Keywords are given for each abstract, and an author index is included. 193 refs.

31112 (EPRI-GS–6381) **Liner-waste compatibility studies for coal-fired power plants.** Haxo, H.E. Jr.; Nelson, N.A.; Haxo, P.D. Electric Power Research Inst., Palo Alto, CA (USA); Matrecon, Inc., Alameda, CA (USA). c May 1989. 184p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This is the Second Interim Report on an extended experimental program, the primary purpose of which is to measure, under conditions that simulate some aspects of field service, the long-term effects of wastes generated by coal-fired power plants on waste impoundment lining materials. Various types of lining materials (including three clay soil, three admix, and eight polymeric membrane lining materials) are being exposed in long-term exposure cells to wastes. The long-term cells feature one-sided exposure of liner samples to a 1-ft head of waste at ambient outdoor temperatures. The wastes include slurries from three fly ashes with different pH values, two flue gas desulfurization sludges, an air-preheater cleaning waste, a boiler-cleaning waste, and a water-treatment brine. This report presents the results of monitoring the soil and admix liners exposed for up to four years and the results of testing the polymeric membranes recovered from the cells that were dismantled after 1 to 2 years of exposure. Also presented are limited results of exposing a wide range of polymeric membranes under various other conditions, including immersion in selected wastes and deionized water, exposure to weathering as slabs, bent loops, or liners in small tubs containing wastes, and exposure in pouch tests to assess membrane permeability. 11 refs., 28 figs., 40 tabs.

31113 (IVL-B–903) **PRENOX tests at recovery boiler 70 at Norrsundets Bruk. A study of NO/sub x/emission in sodium nitrate additions.** Bostroem, C.Aa.; Lindberg, M. Swedish Environmental Research Inst., Goeteborg (Sweden). Sep 1988. 36p. (In Swedish). Order Number DE89766931/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Test runs have been performed at a black liquor recovery furnace to simulate what will happen to the nitrogen oxide emissions when a full scale PRENOX-plant is in operation. Nitrogen nitrate has been mixed into the black liquor burned in the recovery furnace. The emissions of nitrogen oxides was almost doubled compared to burning of normal black liquor. Characterization of effluent from bleaching of PRENOX-treated pulp in comparison with other bleachery effluent has also been carried out.

31114 (Juel–2235) **Treatment of hazardous waste in an iron melt process. A joint study.** Zimmer, E.; Axelsson, C.L. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung. Sep 1988.

109p. Order Number DE89774752/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

The iron bath process has several potential advantages compared to a conventional incineration process for hazardous waste destruction, e.g. in the rotary kiln. The higher temperature should yield faster reaction rates as well as a higher degree of destruction of organic materials. The uniform temperature profile and the homogeneous reaction media make process control easier. The high energy density of the melt leads to high throughputs relative to the reactor volume. In addition, the basic technology for waste treatment in the iron melt is well known from iron and steel making. This study also indicates some uncertainties and also some drawbacks of the process. The process is based on partial combustion, thus resulting in a low flexibility with respect to different feed material. In general, a careful pretreatment of the hazardous waste is necessary before adding it to the melt. In spite of the fact that thermomechanical calculations have demonstrated the quantitative destruction of organic compounds, chemical analyses of the off-gas from coal gasification tests show traces of organic material, for instance aromatic compounds. However, a subsequent combustion of the off-gas is necessary anyway in view of its chemical composition and the energy content. Therefore, a complete decomposition of all noxious compounds can be expected in the combustion step.

31115 (LITH-IKP-EX–690) **Load management - A way of reducing the costs for electric demand at Gustavsberg VVS AB.** Lauber, A.M. Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering. Feb 1988. 94p. (In Swedish). Order Number DE89766899/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

Examination paper.

By way of introduction the background to and aim of the thesis are presented. Then, the demarcations that have been done and the course of action are described. The company and its history is shortly presented, whereupon the conception Industrial Load Management is treated in its own chapter. The results from the part of the project that has been performed at the company, i e mapping and measuring the electricity consumption, have been the basis for subsequent estimate of load management possibilities at the company. The estimate shows that load management would, to all appearances, result in considerable economic savings at Gustavsberg VVS AB at this very moment, but especially in about a year, when new electricity rates will be introduced. In the light of these facts, recommendations for a load management system at Gustavsberg VVS AB are finally given.

31116 (NEI-DK–159) **Building constructions using cement containing a desulfurization product.** Energiministeriets Energiforskningsprogram. Miljoe og restprodukter. Joens, E.; Bjerre-Nielsen, H. Niro Atomizer A/S, Soeborg (Denmark). Dec 1988. 139p. (In Danish). Order Number DE89766853/JAW. Available from NTIS (US Sales Only), PC A17/MF A01;1.

Energiministeriets Energiforskningsprogram. Miljoe og restprodukter.; EFP-85.

When PFA (pulverized fly ash) is used in concrete, it has to meet some rather strict composition requirements with respect to content of sulphur compounds, chloride and carbon and with respect to fineness. When applying flue gas desulfurization by Spray Dry Absorption (SDA) without precollection of PFA prior to the chemical flue gas cleaning, a mixed powder is obtained as residue. This residue has been termed "SDA-ash". The residue cannot meet the above mentioned composition requirements. In order to examine whether such a product can be used in concrete after all, a parking lot has been built using the above mentioned SDA-ash and using "pure" PFA as reference. Laboratory testing has shown both concretes to have same performance although the concrete containing SDA-ash showed a slower strength development. The parking lot has been studied in a period of 15 months without observing any change in performance between the two concrete types. Until now it is concluded that the quality variations within the same concrete type (top and bottom of parking lot) are larger than variations between the two different concretes.

31117 (OAF/AEG–88-3301) **Microprocessor environmental control in a large farrowing complex.** Winfield, R.G. Ontario Ministry of Agriculture and Food, Guelph, ON (Canada). Agricultural Energy Centre. 1988. 16p. (MICROLOG–89-01135;CE–02583). Available from Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C.

A demonstration/evaluation project was undertaken to evaluate the direct energy savings potential attributable to a more sophisticated control system, to determine the cost effectiveness of an initially more expensive control system vs the maintenance costs associated with thermostat relacements, to determine the improved productivity benefits resulting from better environmental control as well as managerial benefits of having more readily available data resulting from being able to adjust control programming more easily, and to assist manufacturers in developing microprocessor technology for the agricultural market and to evaluate the reliability of that equipment in a relatively hostile environment. An obvious need for improved control of environmental adjustment mechanisms, namely exhaust fans and heater, exists. Microprocessor control systems can sequence heating/cooling functions according to a preprogrammed schedule using only one sensor for an environmental space (room) rather than the traditional three to five. The main control (switching) components can often be remotely located in a clean air space with only the sensor(s) remaining in the harsh environment. Control loss causes significant waste of purchased heat energy in heat deficient animal housing units. Among the conclusions were that total direct energy usage rate was maintained or reduced slightly while pig productivity was increased. Thus, a net energy saving per unit of productivity was achieved. Also, electrical demand was reduced a nominal amount in most months. 3 refs., 3 figs.

31118 (OAF/AEG–88-5103) **Development of technology to utilize existing tobacco kilns and/or tobacco storage barns for curing (drying) and/or storage of other crops.** VanHooren, D.L.; Scott, J.J. Ontario Ministry of Agriculture and Food, Guelph, ON (Canada). Agricultural Energy Centre. 1988. 68p. (MICROLOG–89-01137;CE–02582). Available from Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C.

This report investigates methods to utilize existing bulk tobacco kilns for curing (drying) of shelled corn, peanuts, and baled hay. In recent years Ontario tobacco producers have had to reduce production levels due to a declining demand for flue-cured tobacco. Many tobacco producers are currently diversifying into other crops. Some of these crops require curing and/or storage. Because of high capital costs to purchase conventional curing and/or storage facilities, tobacco producers wish to reduce their initial diversification costs by modifying their existing tobacco kilns (tobacco drying structures) and/or tobacco storage barns for this purpose. The investigation included high profile and low profile downdraft stick kilns, bulk kilns, and tobacco storage (pack) barns. Corn, peanuts, and hay were considered in relation to bulk kiln specifications and modifications, handling, drying and storage methods, energy requirements, cost, and quality of end product. The conclusions drawn from the study of each product are presented. Results from the projects indicate that: shelled corn can be dried from about 26% moisture content (w.b.) or less; baled hay can be dried from about 27% moisture content (w.b.) or less; and peanuts cured at airflow rates ranging from 169 to 645 l/s/m/sup 3/of peanuts exhibited no significant differences when evaluated for appearance and flavour. 1 ref., 23 figs., 15 tabs.

31119 (OME–8801) **Radiant wave technology. As a source of energy savings.** Ontario Ministry of Energy, Toronto, ON (Canada). 1988. 21p. (MICROLOG–89-00401). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, , Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Radiant wave technologies include microwave, radio frequencies, and infrared heating as well as ultra-violet curing devices. Unlike conventional heating equipment, where heat is applied to the surface of an object, radiant heating produces heat within the body of the material. The benefits of radiant heating technologies are lower energy costs, reduced floor space requirements, less scrap material, lower exhaust emissions, lower labor costs, greater productivity, and improved product quality. The Ontario Ministry of Energy is evaluating uses of radiant wave technology in a number of industries - ceramics, food processing, pharmaceutical, lamination, and

coating. Regulatory, technical, and economic impediments are identified. A list of Canadian equipment suppliers is provided. 7 refs., 1 fig., 1 tab.

31120 (OME–8802) **A technology status report energy usage and microwave heating potential in Ontario ceramics industry.** Ontario Ministry of Energy, Toronto, ON (Canada). 1988. 34p. (MICROLOG–89-00399). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, , Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

To assess the potential impact of microwave technology on energy use, an energy survey of the ceramics industry in Ontario was undertaken. A total of 209 companies were identified as manufacturers of ceramics. The industry operates 276 kilns, with an energy usage estimated at 1.89 PJ, for the drying and firing processes. The anticipated energy consumption will be approximately 2.2 PJ by the year 2000. The application of microwave energy to current ceramics manufacturing processes can increase product throughput while reducing energy costs, tooling, floor space, and materials handling. The energy saved could reach 0.65 to 0.77 PJ annually. 8 refs., 27 tabs.

31121 (ORF/ES–1988) **An investigation into the state-of-the-art of dielectric heating applications for lamination.** LeBlanc, D. Ontario Research Foundation, Mississauga, ON (Canada). Engineering Sciences Div. [1989]. 90p. (MICROLOG–89-00406). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Radiation curing of coatings and laminations provides products with unique characteristics. The Electron Beam (EB), Ultraviolet (UV), Infrared (IR), and Microwave systems have several advantages over traditional gas or oil fired thermal processes. These are: unique and high value added products, high production speeds through rapid curing, decreased machinery space required, energy efficiency, use of 100% solids coatings (to reduce or eliminate solvent emissions), and possibly improved safety. Secrecy within industry makes evaluations and predictions difficult; however, the total number of processing units in the United States is expected to more than double by 1990. Similar figures exist for Europe and Japan where growth rates of 10 to 20% per year are expected. The driving force for expansion in the industry is primarily from novel products and products with improved quality. Also, higher productivity in some areas justifies the use of equipment with higher capital costs. Energy savings and pollution control have been less significant as driving forces for expansion. Care must be exercised, when evaluating energy consumption of these processes, to include all stages of production. 20 refs., 8 figs., 7 tabs.

31122 (PB–89-158810/XAB) **Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988.** Sawyer, S. Enviresponse, Inc., Livingston, NJ (USA). Feb 1989. 131p. Available from NTIS, PC A07/MF A01.

See also PB–89-158828.

The major objectives of the HAZCON Solidification SITE Program Demonstration Test were to develop reliable performance and cost information. The HAZCON process mixes the hazardous-waste material with cement, a proprietary additive called Chloranan and water. The Chloranan is claimed to neutralize the inhibiting effect that organics normally have on the hydration of cement. The technical criteria used to evaluate the effectiveness of the HAZCON process were contaminant mobility, based on leaching and permeability tests; and potential integrity of solidified soils, based on measurements of physical and microstructural properties. Extensive sampling and analyses were performed showing the concentration of the organics were the same in the leachates of the untreated and treated soils, heavy-metals reductions were achieved, and structural properties of the solidified cores were found to indicate good long-term stability.

31123 (PB–89-158828/XAB) **Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988.** Sawyer, S. Enviresponse, Inc., Livingston, NJ (USA). Feb 1989. 326p. Available from NTIS, PC A15/MF A01.

See also PB–89-158810.

The major objectives of the HAZCON Solidification SITE Program Demonstration Test were to develop reliable performance and cost information. The HAZCON process mixes the hazardous-waste material with cement, a proprietary additive called Chloranan and water. The Chloranan is claimed to neutralize the inhibiting effect that organics normally have on the hydration of cement. The technical criteria used to evaluate the effectiveness of the HAZCON process were contaminant mobility, based on leaching and permeability tests; and potential integrity of solidified soils, based on measurements of physical and microstructural properties. Extensive sampling and analyses were performed showing the concentration of the organics were the same in the leachates of the untreated and treated soils, heavy-metals reductions were achieved, and structural properties of the solidified cores were found to indicate good long-term stability. The volume contains data collected during the project.

31124 (PB–89-162036/XAB) **Use of gas-turbine exhaust for the direct drying of food products. Final report.** Little (Arthur D.), Inc., Cambridge, MA (USA). Jun 1988. 118p. Available from NTIS, PC A06/MF A01.

This report describes an investigation of the use of gas-turbine exhaust as a substitute for conventional burners in the direct drying of food products. Four different equipment configurations were examined, including: diluting exhaust gases with air to achieve suitable temperatures; directing exhaust through a heat exchanger; moving the exhaust through a heat recovery boiler and then a drying system; and utilizing a conventional gas turbine cogeneration system. The study determined that diluting exhaust with air and the heat recovery boiler/drying system were economically attractive. The concern with direct drying using gas turbine exhaust is that the presence of elevated nitrogen oxides in the gas may be found in the food products or cause the formation of nitrosamines (a potent carcinogen) in these products. The study concluded that for direct drying using turbine exhaust to be commercialized for food products, either methods for reducing nitrogren oxides levels must be developed for the turbines of pilot tests combined with food-product analysis have to be performed.

31125 (PB–89-162416/XAB) **Case-Hoyt/Rochester Corporation printing waste heat recovery project. Final report.** Napp, E. RIT Research Corp., Rochester, NY (USA). Feb 1987. 104p. Available from NTIS, PC A06/MF A01.

Portions of this document are not fully legible.

This report documents a demonstration project aimed at recycling the waste heat produced during the ink-drying process at a lithographic printing plant. An emissions-control and heat-recovery system was designed to accomplish three things: (1) reduce gas consumption in dryers, (2) minimize VOC emissions to the atmosphere in the most efficient manner possible, and (3) recover energy from the exhaust to heat part of the building during the winter months. To reduce dryer gas consumption, a unique Lower Flammability Limit (LFL) control system was installed at each press. These systems modulate the exhaust flow of each dryer based on solvent concentration. A central catalytic oxidizer was installed to reduce VOC emissions to the atmosphere and to provide preheated make-up air to the building through the use of a secondary heat exchanger. System energy consumption was monitored for one year and compared to previous energy usage.

31126 (PB–89-164321/XAB) **Risk-assessment methodology for hazardous-waste management. Final report.** Lawless, E.W. Midwest Research Inst., Kansas City, MO (USA). 23 Sep 1988. 325p. Available from NTIS, PC A14/MF A01.

See also PB–86-158912.

A methodology is presented for assessing and comparing the risks to human health and the environment of hazardous-waste-management alternatives, based on a critique of available technical and science policy literature. Methodology is oriented toward site-specific assessments of alternative treatment, storage and disposal facilities. It is designed to be modular, with 7 steps (1) hazard characterization, (2) environmental transport and fate analysis, (3) exposure prediction, (4) health and environmental effects analysis,

(5) estimation of adverse impacts for exposed individuals and populations, (6) uncertainty analysis, and (7) comparison of results across hazardous-waste-management alternatives. Careful aggregation of uncertainties is described. Extensive bibliography.

31127 (PB–89-860159/XAB) **Metals recovery from wastes. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 231p. Available from NTISPC N01/MF N01.

Supersedes PB–88-862008.

This bibliography contains citations concerning the recovery and recycling or reuse of ferrous and nonferrous metals from various industrial wastes, especially waste waters. (This updated bibliography contains 420 citations, 141 of which are new entries to the previous edition.)

31128 (QER–6260) **Recycling of secondary fibers by the Quebec paper industry.** Quebec Ministere de l'Energie et des Resources, Quebec, PQ (Canada). 1988. V (In French). (MICROLOG–89-01590). Available from Ministere de l'energie et des ressources, Direction des Communications, 200, chemin Ste-Foy, 7e etage, Quebec, PQ, Canada G1R 4X7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

After a general introduction to the recycling of paper, an overview is given of the Quebec paper industry and its recycling practices. Data were obtained from a literature review and an industry survey. Secondary fibers only represent a relatively minor part of the total supply to the industry in Quebec. In 1985, about 5% of total plant consumption was comprised of recycled paper and cartons. Those plants utilizing secondary fibers in 1985 have been grouped into 3 categories: carton plants, toilet paper plants, and plants manufacturing construction material. There are no newsprint plants utilizing de-inked newspaper pulp. About 65% of recycled fibers were used by carton manufacturers. It is noted that due to insufficient supplies in Quebec, around 35 to 45% of secondary fiber consumption is imported from the USA and from Ontario. The prices of secondary fibers fluctuate according to the same factors observed in the case of pulp and commercial paper products; nevertheless, the amplitude of the price cycles is significantly different according to the market. The technology of utilizing secondary fibers is reviewed, and the advantages and disadvantages of paper recycling are noted. It is seen that elimination of contaminants such as glass, metals, and inks poses the greatest problem to utilizing those fibers. In spite of these problems, recycling is economically beneficial for the paper industry; it lowers supply costs, saves energy, and requires lower investment compared to those industrial processes starting from raw wood. Paper recycling also offers an alternative to an excessive use of the province's wood resource. 60 refs., 21 figs., 26 tabs.

31129 (SC–2494CP) **Chemical heat pump study. Final report.** Stearns Catalytic Ltd., Sernia, ON (Canada). 1987. 109p. (MICROLOG–88-06402). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, , Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A chemical heat pump application has been optimized in an attempt to obtain an economic installation in the petrochemical industry. Potential vendors were contacted to determine their interest in bidding on a lithium-bromide installation at the Ontario host company, Polysar Vendors were not prepared to bid on the application chosen due to the high temperature, even though this was less than the recognized maximum temperature of 165/sup 0/C. A new absorption fluid consisting of a tertiary nitrate is described and a design formulated in order to review the economics of the process. The heat pump using this fluid is referred to in this report as the High Temperature Chemical Heat Pump. A payout of four years was obtained when using typical industry steam costs, but this payout is in excess of fifteen years when Polysar's steam costs and conditions are used in the analysis. Comparisons between the two common types of heat pumps indicate that the installed cost of the mechanical heat pump is three times higher than that for the chemical heat pump. The High Temperature Chemical Heat Pump can be an economical option for energy conservation applications and some industrial applications. It will provide higher temperature lifts and work at higher temperatures than previously permissible with lithium-bromide. Integration of the heat pump in the grass-root design of the plant will also increase the viability of this system. 13 refs., 34 figs., 7 tabs.

31130 (SHA–527U537) **Steam substitution in chemical process, petrochemical and petroleum industries.** MacLeod, D.M. Simons (H.A.) Ltd., Vancouver, BC (Canada). 1987. 133p. (CE–02595). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The primary focus of the study was to explore the potential for electric resistance heating as a substitute for conventional steam and direct-fired heating in the petroleum, petrochemical and chemical industries. The potential of replacing steam ejectors with vacuum pumps and steam tracing with electrical tracing was also assessed. Direct resistance heating elements for small and intermediate loads and thermal oil-based systems for large leads were adopted as the most feasible technology for purposes of this study. The study considered potential benefits by major Canadian regions for the chemical, petrochemical and petroleum industries. The cost/performance advantage was evaluated for typical oil refining and integrated petrochemical complexes, as well as principal chemical processes. The clearest area of potential identified is in the substitution of electric-based heat tracing and vacuum equipment in refineries, petrochemical, and chemical process plants. The basis of substantial net annual savings is the superior efficiency of electricity as compared with steam for these applications. Emphasis should be placed on appraising plant owners of the technical and economic advantages of replacing existing steam-based heat tracing systems and vacuum ejectors with electric heat tracing and vacuum pumps.2 refs., 12 figs., 48 tabs.

31131 (STF–45A84002) **New methods for the covering of the energy demand of agriculture. Mobile electric operation.** Nordaunet, L. Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Apr 1984. 63p. (In Norwegian). Order Number DE89766877/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

The report concerns new methods to cover the energy demand in agriculture, and focuses on the use of mobile electric operation. The design of a battery-powered tractor is presented, and the operation conditions such as the operating time, mode of operation, and use of implements are discussed. In addition, main requirements in this connection are also the weight level, working life, and cost level in relation to a diesel-powered one. Various types of batteries are described, and information on the use and maintenance of the most actual types of batteries are added. 12 figs., 1 tab., 17 refs.

31132 (SU/EE–309U403) **Farm losses resulting from electric service interruption.** Wacker, G.; Billinton, R.; Brewer, R.E. Saskatchewan Univ., Saskatoon, SK (Canada). Dept. of Electrical Engineering. 1987. 143p. (CE–02611). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

A postal survey of farm operators across Canada was conducted to evaluate the direct and short-term costs or losses incurred in the agricultural sector as a result of local random electrical supply interruptions. Farms were categorized according to Statistics Canada's Standard Industrial Classification (SIC) of farm types. The group and subgroup sample sizes were selected to reflect their relative importance to the various geographical regions across Canada. Most Canadian utilities which serve farm customers participated in the project. The results obtined from this survey provide cost-of-interruption estimates and variations as functions of user and interruption characteristics. User characteristics include SIC farm type, yearly electrical consumption and peak demand, availability and size of backup power, geographic region in Canada, and demographic information. Interruption characteristics include frequency, duration, and time of occurrence of the interruption. Interruption cost estimates vary among SIC groups and among Canadian geographical regions, and are presented on a cost per interruption basis as

well as on consumption- and demand-normalized bases. Comparison with other sectors reveals that, to a large extent, agricultural sector costs are similar in order of magnitude to residential sector costs. As with other sectors, caution is required in the application of representative sector costs because of cost variations by sector subcategory and load mix considerations. 13 Refs., 13 figs., 40 tabs.

31133 (VI–422USOA) **Radiant heating potential of Vortek arc lamps.** Corbet, B. Vortek Industries Ltd., Vancouver, BC (Canada). 1985. 7p. (CE–02592). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objective of this project was to identify industrial processing opportunities in which controlled, high intensity, argon arc optical heat sources might be substituted for fossil fueled heat sources. The potential for substituting high intensity arc lamps for other heat sources appears high in materials processing applications such as the drying of printing ink, the drying of paper and paper coatings, surface heat treating, surface cleaning/paint removal and photolithography. This report describes the characteristics of the Vortek argon arc lamp, its present applications and its potential applications. It then identifies specific radiant heating applications and assesses the technical and commercial feasibility of those determined to be most promising. No one application has emerged as the clear successor to semiconductor annealing. A number of opportunities appear to exist to replace other radiant heat sources with high intensity, controllable optical heat sources. Some of these involve large markets. 2 refs., 1 fig.

3206 Municipalities and Community Systems

Refer also to citation(s) 30672, 30702, 30703, 31126, 31580, 31680, 31949, 31988

31134 (BCMEP–8807) **The provincial role in municipal solid waste management. A discussion paper.** British Columbia Ministry of Environment and Parks, Victoria, BC (Canada). 1988. 43p. (MICROLOG–88-05587). Available from British Columbia. Ministry of Environment and Parks, Parliament Bldgs., Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

As part of the development of policies that are intended to meet British Columbia's municipal waste management needs, a discussion paper is presented concerning the waste management options currently available as well as those options proposed by the provincial environment ministry. The paper is based on a survey of solid waste management methods currently undertaken by municipalities and regional districts, and a review of assistance programs in other jurisdictions. All aspects of solid waste management are examined: collection and disposal, recycling, procurement policies for supporting purchase of products containing recyclable materials, beverage container and litter control, energy and resource recovery, and funding of solid waste management programs. The paper is intended to serve as a focus for public discussion of solid waste management strategy. 8 refs., 3 figs., 1 tab.

31135 (BFR-R–92-1988) **Cold district heating from a quarry at Kaageroed. Evaluation of an experimental building project.** Hecktor, B.O.; Ekholm, N.I. Swedish Council for Building Research, Stockholm (Sweden). 1988. 42p. (In Swedish). Order Number DE89766935/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Technology and economy of a cold district heating project is discussed in this report. Two small fuel oil fired heating centrals have been supplied with heat pumps extracting heat from water pumped from an abandoned quarry 1 km from the heating centrals. The water is transported in uninsulated PE tubes. The system design, operating experiences from 2 years, and a year-long analysis of load, energy use and heat pump performance are reviewed. (L.E.).

31136 (CONF-890624–1) **Friction-reducing additive scale-up experiments in a pilot-scale DHC system simulator.** Choi, U.S.; Kasza, K.E.; Liu, K.V. Argonne National Lab., IL (USA). May 1989. 12p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 80. annual conference of the International District Heating and Cooling Association; Virginia Beach, Virginia, USA; 18-21 Jun 1989. Order Number DE89013287/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Friction reducing additive scale-up experiments were carried out with 200 wppm Separan solution and 2000 wppm Kemamine solution in a test section with a nominal pipe diameter of 6.0 inches and a length of 70 feet. The experimental results of pressure drop tests of Separan and Kemamine indicate that the friction reduction is not affected by pipe size when the solution is fresh. However, short-term degradation tests show that the high molecular weight polymer solution degrades completely due to the high pump shear and aging, while the surfactant solution does not lose its friction reduction effectiveness because of the high pump shear and appears to have a long lifetime. 9 refs., 8 figs.

31137 (DOE/CE/26561–T1) **Open cycle heat pump development for local resource use Phase II district heating case study analysis: Progress report, 1 January 1989–30 March 1989.** DiBella, F.; Becker, F.E.; Glick, J. TECOGEN, Inc., Waltham, MA (USA). May 1989. 40p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG01-88CE26561. Order Number DE89012400/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A district heating system is proposed that uses low-level waste-energy sources, and a quasi open-cycle steam heat pump as a means of upgrading the energy in the form of hot water to use as a transport medium in the system. the use of a water-based, open-cycle heat pump appears to be extremely well suited in terms of its potential thermodynamic performance, cost, and environmental safety compared to more typical organic gased closed cycle systems. The Phase II case study provides a detailed analysis of a district heating system that utilizes the open cycle steam heat pump concept developed in Phase I. This quarterly report describes the energy audit performed on the heat source and heat sink.

31138 (IEACG–69064-01-SQ-FR) **Comparative evaluation of hot water and steam distribution systems for district heating. Final report.** IEA Consulting Group Ltd., Charlottetown, PE (Canada). 1988. 178p. (MICROLOG–89-01724). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objective of this study was to describe the alternative steam and hot water distribution technologies and to develop a comparative analysis. Two distinct heating systems were selected for case study analysis. The first case study was based on a prospective new distinct heating system in downtown Charlottetown, Prince Edward Island. Such a system would have approximately 40 subscribers and a total connected load of 12 MW. The second case study was based on the existing steam distribution system at McMaster University in Hamilton, Ontario. At the time of this study, it connected 33 campus buildings and a hospital, and had a total load of approximately 33 MW. The general conclusion is that hot water distribution systems will have lower life cycle costs than steam systems for most space heating applications. Steam systems offer greater flexibility and may be used when special requirements, such as process steam loads, must be met. Appendix 1 is a glossary of relevant technical terms. Appendix 5 is a review of the current status of hot water boiler applications in Canada. 9 refs., 33 figs., 15 tabs.

31139 (IEACG–69064-01-SQ-S) **Comparative evaluation of hot water and steam distribution systems for district heating. Summary.** IEA Consulting Group Ltd., Charlottetown, PE (Canada). 1988. 21p. (MICROLOG–89-01724). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The objective of this study was to describe the alternative steam and hot water distribution technologies and to develop a comparative analysis. Two distinct heating systems were selected for case study analysis. The first case study was based on a prospective new distinct heating system in downtown Charlottetown, Prince

Edward Island. Such a system would have approximately 40 subscribers and a total connected load of 12 MW. The second case study was based on the existing steam distribution system at McMaster University in Hamilton, Ontario. At the time of this study, it connected 33 campus buildings and a hospital, and had a total load of approximately 33 MW. The general conclusion is that hot water distribution systems will have lower life cycle costs than steam systems for most space heating applications. Steam systems offer greater flexibility and may be used when special requirements, such as process steam loads, must be met. Appendix 1 is a glossary of relevant technical terms. Appendix 5 is a review of the current status of hot water boiler applications in Canada. 9 refs., 33 figs., 15 tabs.

31140 (LPI–520U527) **Roadway lighting equipment management systems. Preliminary review: final report synopsis. [B] User standards for luminaire specifications, vol. 1.** Soltau, R.L. Lighting Perceptions, Inc., Markham, ON (Canada). 1989. 66p. (CE–02616). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objective of this project was to identify the current levels of information management in practice throughout the Provincial and Municipal Hydro Utilities in Canada, used in the specification, management and maintenance of Roadway/Streetlighting Systems under their jurisdiction, so as to develop and implement three systems to improve the specification, management and maintenance of Roadway/Streetlighting. The program included the use of direct-mail questionnaires, research in the field of Facilities Management throughout North America and a survey of the industry's technical reports, conference proceedings and published literature on state-of-the-art Management of Information Systems, Data Base Managers, High Intensity Discharge (HID) Lighting Systems, Maintenance Practice and Standards of the respective professional institutions, manufacturers, and major users of HID lighting systems-with emphasis on experience with HPS systems. The three products developed - a PC-DOS based Facilities Management of Information System (USER MIS), a Standard Performance Specification Format for HID Luminaires (USER STANDARDS) and a Field Maintenance Manual (HPS USER MANUAL) - provide information resources and training tools for optimising the performance of Roadway/Streetlighting, effectively reporting on all installation and maintenance activities, including costs associated with each field-replaceable component, selectively by pole location, street, area or luminaire type. A series of model specifications and a glossary of terms are provided. 10 figs.

31141 (MEC–628USOA) **Low pressure sodium roadway lighting.** Young, P.P. Macro Engineering Consultants, Vancouver, BC (Canada). [1989]. 36p. (CE–02596). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Low pressure Sodium is an efficient light source, but its application in roadway lighting in Canada is limited. This study looks at equipment available by listing luminaires, their features and application categories. Three typical roadway lighting design exercises were performed comparing the use of Low Pressure Sodium (LPS) against the more common High Pressure Sodium (HPS). A series of designs for different roadway widths and categories using LPS in comparison with HPS (cobra-head systems) was undertaken for: local/residential using one side mounting, collector intermediate using 2 side staggered mounting, and major intermediate divided, using median mounting. The study found that LPS can be justified for most non-commercial roadways, especially in median mounting on divided highways. The energy saving qualities of LPS become justifiable based on payback calculations for energy rates of approximately 9 cents/kWh. Major LPS lighting users were surveyed in regards to their experience and attitude towards the use of the source. Sample designs comparing LPS with the more common cobra-head HPS systems found that where the source can provide comparable spacing to the HPS system, it can be justified, especially in higher energy rate areas. LPS offers low brightness, visibility enhancing lighting for non-color-critical applications, although the higher price of LPS lamp and equipment makes it a little harder to justify in comparison with HPS. Careful design and selection of luminaire photometrics can make LPS justifiable. 7 refs.

31142 (NEI-DK–154) **Deterministic chaos in energy-technichological systems.** Togeby, M. Danmarks Tekniske Hoejskole, Lyngby. Fysisk Lab. 3. 1988. 124p. (In Danish). Order Number DE89766836/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

The thesis is concerned with non-linear dynamic phenomena in technical systems. Emphasis has been given to autonomous systems with self-sustained oscillations. An example of instabilities in a refrigeration plant and an introduction to non linear dynamics are given. It is shown how coupling between two autonomous oscillators can give rise to quasiperiodic solutions. Examples of chaotic motion with simple models are presented. A detailed model of two coupled thermostatic radiators is described. The combination of the chosen parameters for the amplification and the delays in the system causes the control to be unstable, as does hysteresis caused by mechanical friction. The coupled system exhibits periodic, period-doubled, quasiperiodic and chaotic behaviour. Chaos is found where strong coupling between the two radiator systems exists while quasiperiodic behaviour is found in relation to lower values of the coupling parameter. A devil's staircase of periodic solutions is obtained when a parameter influencing the natural frequency of one of the radiator systems is Changed. When coupling is increased above a critical value the quasiperiodic solutions are replaced with chaotic motions. An adaptive control system with variable gain parameters is dealt with. Interaction between the adaptive system and oscillations caused by relays in the heat consuming part can lead to chaotic motion. A time constant used for smoothing an estimated parameter is used as a bifurcation parameter. The sensitivity of initial conditions is demonstrated by following a disturbed and a non-disturbed solution in a sort of stroboscopic projection. The exponential growth of small disturbances can be followed clearly in the chaotic regime and the damping of disturbances can be seen when the solution has periodic or quasiperiodic attractors. (AB) 68 refs.

31143 (NEI-DK–156) **Low temperature heating in existing buildings.** Andersen, N.B.; Grimmig, M. Teknologisk Inst., Tastrup (Denmark). Jun 1988. 57p. (In Danish). Order Number DE89766839/JAW. Available from NTIS (US Sales Only), PC A04/MF A01;1.

EFP-81.

It is suggested that the temperature is unnecessarily high in many buildings connected to district heating systems and that this is partly due to Danish tradition, and partly to the character of the heating installations. It is shown that the temperature can be lowered in individual buildings without retrofitting as many radiators have an unnecessarily large heating capacity, but lowered temperatures will not result in a significant reduction of heat losses from pipes. It should be possible, however, to reduce heat losses in the process of underground heat transmission to the rate of 0,1 to 0,4% per deg. C according to individual circumstances. Energy savings in relation to heat production would be, in the case of conventional oil and gas boilers, 0,1 to 0,7% per deg. C, for larger district heating plants - 0,04 to 0,08% deg. C, whereas for dual purpose power plants energy savings would be 0,4% per deg. C. The technical details for achieving low temperature operation in existing buildings are described and possibilities for saving energy in this way are explained more fully, as are also methods for evaluating the extent of energy saving in buildings where space heating temperatures are lowered. (AB) 17 refs.

31144 (NEI-DK–158) **Adhesion between polyurethane insulation and media tubes.** Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme. Meyer, J.M. Jysk Teknologisk, Aarhus (Denmark). Afdelingen for Plastteknik. Dec 1988. 20p. (In Danish). Order Number DE89766852/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme.; EFP-85.

The examination has included the adhesion between polyurethane insulation and media tubes in pre-insulated district heating pipes. The examination shows that a sand blasting up to at least SA 2 is necessary in order to achieve a secure adhesion as SA 1 as well as brushing off loose rust result in a remaining layer of

rust which is not soaked by the polyurethane insulation and which during ageing according to ECN EN 253 is converted from a coherent layer into a loose powder thus reducing the adhesion. By foaming pre-insulated pipes in the laboratory as well as under industrial conditions we have further found that the best adhesion is achieved if the media tubes have a temperature before foaming in the range of 20-30 deg. after ageing. In connection with this examination shrinkage cracks were found in the cellular plastics on some individual pipes from a production. During normal factory control no important deviation from the normal production was found on these pipes. A thermomechanical analysis shows, however, that the material has a considerably lower softening temperature than normal pipes, and the cause of faults is to be found in a mixing fault or formulating fault. The thermo-mechanical analysis can thus be used for a rapid evaluation of whether the system is thermally stable, that is as a production control as a supplement to the proper ageing test.

31145 (NEI-DK–160) **Bio-adsorption (Pilot-scale). Investigation of cleansing effect and sludge formation.** Krueger (I.) A/S, Copenhagen (Denmark). Jul 1988. 85p. (In Danish). Order Number DE89766854/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

EFP-83.

The aim of the project was to investigate the process of bioadsorption in relation to the purifying of sewage waste where the oxygen levels were 0%, 2.5% and 10%. Cleansing results for 2.5% oxygen saturation was 50-70% for BOD and 30-50% for COD. Reduction of nitrogen and phosphorus was 15-20% and 20-25%. 40% of the removed nitrogen, and the organic bound phosphorus, was returned to the system via the internal reject-flow and thus to the biological processing. The tendence to sludge production was heightened where oxygen saturation was moderate. It is reckoned that operational costs were reduced by 10 Danish oere per cubic meter waste water where the unprocessed waste had a content of 250mg BOD/1. (AB).

31146 (NEI-DK–168) **Dynamic characteristics of PUR cellular plastic in pre-insulated district heating pipes.** Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme. Amby, L.; Meyer, J.M. Jysk Teknologisk, Aarhus (Denmark). Afdelingen for Plastteknik. Mar 1989. 98p. (In Danish). Order Number DE89776122/JAW. Available from NTIS (US Sales Only), PC A05/MF A01;1.

Energiministeriets Energiforskningsprogram. Fjernvarme og produktion af el og varme.; EFP-86.

PUR cellular plastic is investigated (in relation to its uses in pre-insulated district heating pipes of differing dimensions) for deformation as a result of pressure. Results showed that PUR cellular plastic behaved in a satisfactory way under conditions where the pipes were level and the temperature did not exceed 130 deg. C and where the temperature did not vary more than 30 deg. C. Friction from the earth, however, did result in too heavy a strain on the material when the pipes became extended in length. The surrounding temperatures had a significant influence on the ability of the plastic to withstand fluctuating temperatures within the pipes. There seemed to be no problems concerning the material's adherence to the pipes. Other types of cellular plastics have not been tested. (AB).

31147 (NEI-DK–170) **Humleby's heating supplies. Investigation of the possibilities for establishing local heat supply based on renewable energy in the Humleby area.** Miljoe- og Energikontoret, Copenhagen (Denmark). Dec 1988. 104p. (In Danish). Order Number DE89776135/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

A cost-benefit analysis of possibilities for initiating a district heating system based on solar energy, and possibly combined with Copenhagen's municiple heating system, in a specified smaller area of Denmark's capital. Heat consumption of local residences in relation to conditions of insulation and erection of glass extensions for utilizing solar energy are examined, as are low temperature heating systems placed in cellars or in front gardens (or streets) and high temperature systems in back gardens or cellars. It is concluded that the local inhabitants would not have to pay more for such forms of heating and that glass extensions would improve individual economy and increase the standard of individual buildings. It is recommended that negotiations should be taken up with the Copenhagen authorities and the firm of Carlsberg on the possibilities for using surplus heat from their heating systems, in combination with the on-site systems. (AB).

31148 (NSME–8810) **The Minister's Task Force on Litter Abatement. Report.** McInnes, P. Nova Scotia Ministry of the Environment, Halifax, NS (Canada). 1988. 74p. (MICROLOG–89-01292). Available from Nova Scotia Legislative Library, PO Box 396, Halifax, NS, Canada B3J 2P8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A task force on litter abatement was announced in the Nova Scotia Legislature by the provincial environment minister. The task force was established to provide the minister with recommendations on the most effective means of achieving and maintaining a litter-free Nova Scotia. This document reviews the litter and recycling issues examined and the methodology employed by the task force, as well as recommendations made concerning government policies. As part of its mandate, the task force was requested to examine existing litter legislation including the Beverage Containers Act and the role of recycling in the province. The task force prepared a discussion paper that was widely distributed. Subsequently, the task force held public meetings in which it heard oral presentations and comments from audience participants. In addition, submissions were received from a wide array of interested parties, including individuals, businesses, industry associations, academics, governments, and environmental groups. The submissions outlined a number of concerns on litter and recycling and indicated that there is a strong interest in Nova Scotia for having an aesthetically pleasing province. With the implementation of the recommendations outlined in this report, the task force feels that these concerns of Nova Scotians will be addressed and result in a litter-free environment and the development of a strong recycling industry. These recommendations are listed under the categories of litter legislation and enforcement, encouragement of recycling and waste recovery, and public education. Includes glossary.

31149 (PB–89-162382/XAB) **Evaluation of rotary-drum air classification of shredded and unshredded municipal solid waste. Final report.** Nollet, A.R. AENCO, Inc., Minnetonka, MN (USA). Jan 1987. 170p. Available from NTIS, PC A08/MF A01.

This report describes the capabilities of the Rotary Drum Air Classifier (RDAC) demonstrated at an Albany, NY shredding plant. Air classification using the RDAC has been proposed as an effective and efficient method for producing a better refuse-derived fuel (RDF), with better combustion characteristics and reduced concentrations of metals and chlorine-bearing wastes. During this project a 40-ton-per-hour, transportable RDAC was used to air-classify over 3,000 tons of shredded municipal solid waste (MSW) and over 100 tons of unshredded MSW. The RDAC was found to be effective in removing undesirable, heavy materials from the shredded and unshredded MSW. RDF made using the classifier produced more steam per pound than the usual, unclassified RDF.

31150 (PB–89-165260/XAB) **Buffalo district heating and cooling system: technical and economic assessment. Final report.** Jennings, E. Resource Development Associates, Inc., Dayton, OH (USA). Jun 1985. 128p. Available from NTIS, PC A07/MF A01.

The information in the report identifies and describes district heating and cooling opportunities for downtown Buffalo. It reviews technical and economic data necessary to building such a system, including a market study of how many buildings would use the system, energy-price projections, regulations governing such systems, ownership options, expansion proposals, and a plan of implementation. Certain buildings were selected for a survey to develop energy-use profiles. All evaluations were made within the context of the downtown energy-use patterns. This Phase One project concludes that it is feasible to build a pilot-scale system for downtown Buffalo and to design it with expansion capability; and that such a system would be both economical and energy efficient.

31151 (PB–89-165385/XAB) **Rochester district-heating-system reconfiguration: technical and economic feasibility. Final report.** Hanselman, W.G. Resource Development Associates,

Inc., Dayton, OH (USA). Feb 1986. 384p. Available from NTIS, PC A17/MF A01.

This project examined the feasibility of reconfiguring the Rochester District Heating System. The methodology consisted of three parts. First, a viable steam system ownership alternative (the Rochester District Heating Cooperative) was identified, characterized, incorporated, and made operational. Second, a technical institutional and financial analysis was conducted of the downtown steam system and several alternative-system configurations were identified. Third, a definitive, well-documented alternative to steam system abandonment was proposed. The Rochester Steam System Assessment was conducted between May 1984 and January 1985. During this period all aspects of steam system revitalization/ reconfiguration were evaluated and documented; and the Rochester District Heating Cooperative began the process to acquire and revitalize the downtown Rochester steam system.

31152 (QME–1988) **Recycling of iron and steel. State of the situation.** Lalante, D. Quebec Ministere de l'Environnement, Ste-Foy, PQ (Canada). 1988. 90p. (In French). (MICROLOG–89-01185). Available from Ministere de l'environnement, 3900, rue Marly, Ste Foy, PQ, Canada G1X 4E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The characteristics, production, fabrication, and utilization of ferrous metals are reviewed in the Quebec context. The ferrous metal industry in that province has shown a decrease in activity during the early '80s and has subsequently indicated a stabilization or slight increase. The Quebec steel industry is mainly based on melting of scrap; consumption of scrap increased in 1983 by 11.7% and in 1984 by 21.7% with respect to the previous year. This trend follows the general Canadian pattern of a 4-5% yearly increase foreseen to 1990. Waste recovery companies in Quebec produced 1.65 million tons of prepared scrap in 1985, of which 250,000 tons was exported. The main limitation to increased recovery is availability; sources of waste ferrous metals are insufficient, and recuperators and recyclers must seek out-of-province supplies. Ferrous metal producers fabricate alloys of varying composition and require high quality scrap from their suppliers. Limits on the amounts of contaminants are strict, and this tendency is seen to become more severe in the future, especially in plants supplied entirely by scrap. There are also economic constraints on scrap recovery, namely the cost of equipment and transport costs. Recycling of ferrous metals is seen as having many advantages, including reduction of waste and pollution, and energy savings. Under-utilized categories of metal waste are incinerator residues and tin cans. The former are too contaminated to be recycled. Tin cans are recyclable and, in spite of their tin content, it is possible to use them directly in melting furnaces. 28 refs., 5 figs., 16 tabs.

31153 (STEV-FJV–89-1) **Optimization of the total efficiency of district heating production.** Wiklund, H.; Sandberg, O. Statens Energiverk, Stockholm (Sweden). 1988. 125p. (In Swedish). Order Number DE89766928/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

This report is concerned with studies of different factors in a district heating plant and the roles which they play in attaining optimum energy production. First a study is made of separate production units. It is shown that the intermittent usage of a unit is a more important factor than its efficiency. It is also shown how environmental factors must be considered when waste is used as fuel. Use of a central accumulator to minimize the influence of load variations was studied with respect to both control factors and working costs. The analysis shows that an accumulator is only efficient on a short-term time scale, which thereby determines the optimum size of the accumulator. Effective use of the accumulator presupposes forecasts of the heat load and its variation, on a 24 or 48 hour basis. A great portion of the report is concerned with the development of a method for heat load prediction. The significance of different influences such as the outdoor temperature, the time of day and the supply temperature at the generating plant, are thoroughly studied. Finally, a computer based system was developed to monitor and model the operation of the plant and examples of its operation are given. (authors).

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

31154 (EMR/TE–88-7) **Proceedings of the fourth Windsor workshop on alternative fuels.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). Transportation Energy Div.; Ontario Research Foundation, Sheridan Park, ON (Canada). 1988. 310p. (CONF-8806312–: Coal derived fuels, Toronto, Canada, 5-10 Jun 1988;MICROLOG–89-00745;CE–02570). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This workshop deals with the application of alternative fuels to automotive transportation. Topics covered are the retrofitting of internal combustion engines, future hydrocarbon fuels, alcohol fuels, gaseous fuels, the control of gaseous or particulate emissions, and alternative fuels. Seven papers have been abstracted.

3301 Internal Combustion Engines

Refer also to citation(s) 31124, 31285, 31287

31155 (AD-A–204154/9/XAB) **Heat-transfer predictions and experiments in a motored engine.** Yang, J.; Pierce, P.; Martin, J.K.; Foster, D.E. Wisconsin Univ., Madison, WI (USA). Engine Research Center. 1988. 19p. Available from NTIS, PC A03/MF A01.

In the first part of this study, a one-dimensional code was used to compare predictions from six different two-equation turbulence models. It is shown that the application of the traditional K-E models to the viscous-dominated region of the boundary layer can produce errors in both the calculated heat flux and surface friction. A low-Reynolds-number model does hot appear to predict similar nonphysical effects. A new one-dimensional model, which includes the effect of compression, has been formulated by multiparameter fit to the numerical solution of the energy equation. This model can be used in place of the law-of-the-wall to calculate the surface heat flux. The experiments were performed in a specially-instrumented engine, allowing optical access to the clearance volume . Measurements of heat flux, swirl velocities, and momentum boundary layer thickness were made for different engine speeds. Comparison of the model predictions with the results from the experiment showed good agreement.

31156 (AD-A–204522/7/XAB) **Analysis and in-cylinder measurement of particulate radiant emissions and temperature in a direct-injection diesel engine.** Yan, J.; Borman, G.L. Wisconsin Univ., Madison, WI (USA). Engine Research Center. Sep 1988. 25p. Available from NTIS, PC A03/MF A01.

In-cylinder flame temperature and particulate concentration were measured in a Cummins single-cylinder NH diesel engine by means of an optical radiation probe using the two-color theory. The radiation probe consists of a specially designed trifurcated fiber optical bundle and a sapphire rod window. A self-cleaning window was designed, which stays clean under steady state full load conditions. The engine was operated at various conditions for both standard cooled and simulated mini-cooled configurations. The heat release rate data and exhaust emissions, NO, NOx and CO are presented along with the radiant emission data. Increasing the coolant temperature gave slightly more exhaust soot production as well as in-cylinder soot production, because more late burning occurred at the higher coolant temperature. It is believed that increased late burning was caused by the delayed end of injection and lower injection rate, perhaps due to thermal-expansion effects in the injector. Experimental data were used to evaluate the potential radiation heat transfer.

31157 (CONF-890108–1) **Future applications of engine ceramics: Factors influencing market opportunities, timing, and growth.** Larsen, R.P. Argonne National Lab., IL (USA). 1989. 4p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Ceramtec '89; Dearborn, Michigan, USA; 30 Jan - 2 feb 1989. Order Number DE89012426/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Since 1986, the Center for Transportation Research (CTR) at Argonne National Laboratory has conducted market-based research focusing on the use of ceramics in heat engines for transportation applications. The purpose of my presentation is to share some of the insights we have gained over the past several years and some of the techniques we have found useful in making projections for engine ceramics. For these studies, which are funded by the US Department of Energy, we developed a modeling technique that is useful in examining different scenarios for the timing and growth of the market for engine ceramics. I want to make you aware of these models and how to interpret them and use their results and other information from our research for decisions in your organizations. The data used in developing the models were gathered in a comprehensive worldwide Delphi survey designed to determine when ceramic engine components and ceramic intensive engines would become available in the United States. Information was also gathered on the rate of market growth for engine ceramics, incentives and barriers to their use, and the status of international competition for the worldwide engine ceramics market. 1 fig.

31158 (DTH-LET-NE–88-1) **Internal combustion engines. Effect, and diagrammatic calculations.** Skov, E.; Sorenson, S.C. Danmarks Tekniske Hojskole, Lyngby (Denmark). Lab. for Energiteknik. 1989. 109p. (In Danish). Order Number DE89776133/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

A detailed description of mathematical and diagrammatic methods of calculating the power effects of all kinds of internal combustion engines. (AB).

31159 (ORNL/M–755) **Ceramic Technology for Advanced Heat Engines Project data base: September 1988 summary report.** Booker, B.L.P. Oak Ridge National Lab., TN (USA). Mar 1989. 100p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE89012888/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

A large volume and wide variety of data on the behavior of advanced ceramic materials are currently being generated within the Ceramic Technology for Advanced Heat Engines project (CTAHE). This is the second in a series of reports summarizing the data stored in the microcomputer-based CTAHE data base. Each report features a different class of ceramics, with as much information on materials in that class as has then been processed. This report concentrates on zirconia-based ceramics.

31160 (PB–89-159818/XAB) **Evaluation of a resistively heated metal-monolith catalytic converter on a gasoline-fueled vehicle. Technical report.** Piotrowski, G.K. Environmental Protection Agency, Ann Arbor, MI (USA). Dec 1988. 30p. (EPA/AA/CTAB–89/12). Available from NTIS, PC A03/MF A01.

The major portion of hydrocarbon and carbon monoxide emissions measured from a catalyst-equipped gasoline vehicle over the Federal Test Procedure (FTP) cycle are generated during the cold start and warmup of the catalyst. These emissions are difficult to control because engine-out emissions are high and catalytic converters have low conversion efficiency during their warm-up phase of operation. A resistively heated metal-monolith catalyst was evaluated by EPA Motor Vehicle Emission Laboratory on a methanol-fueled vehicle. Results from this previous testing indicated the feasibility of the concept of a resistively heated metal-monolith substrate as a quick light-off catalyst support. This report describes the evaluation of such a catalyst on a gasoline-fueled vehicle. The vehicle was tested at 72-74°F ambient test-cell conditions and at 20° ambient 'cold-room' conditions.

3302 External Combustion Engines

31161 (LA–11560-MS) **KIVA-II: A computer program for chemically reactive flows with sprays.** Amsden, A.A.; O'Rourke, P.J.; Butler, T.D. Los Alamos National Lab., NM (USA). May 1989. 158p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-36. Order Number DE89012805/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This report documents the KIVA-II computer program for the numerical calculation of transient, two- and three-dimensional, chemically reactive fluid flows with sprays. KIVA-II extends and enhances the earlier KIVA code, improving its computational accuracy and efficiency and its ease-of-use. The KIVA-II equations and numerical solution procedures are very general and can be applied to laminar or turbulent flows, subsonic or supersonic flows, and single-phase or dispersed two-phase flows. Arbitrary numbers of species and chemical reactions are allowed. A stochastic particle method is used to calculate evaporating liquid sprays, including the effects of droplet collisions and aerodynamic breakups. Although the initial and boundary conditions and mesh generation have been written for internal combustion engine calculations, the logic for these specifications can be easily modified for a variety of other applications. Following an overview of the principal features of the KIVA-II program, we describe in detail the equations solved, the numerical solution procedure, and the structure of the computer program. Sixteen appendices provide additional details concerning the numerical solution procedure. 67 refs., 29 figs.

3303 Electric-powered Systems

Refer also to citation(s) 30961, 30964, 30965, 31053, 31131

31162 (STU–83-4640) **Test program for electric vehicles and a follow-up of Swedish activities in this area.** Johansson, A. Swedish National Board for Technical Development, Stockholm (Sweden). 9 May 1988. 6p. (In Swedish). Order Number DE89766904/JAW. Available from NTIS (US Sales Only), PC A02/MF A01;1.

Some twenty electric vehicles have been tested during three years. For some of the vehicles, battery test have been performed regularly. The evaluation concludes that the operational reliability has been high, but that both investment and operational costs are high. (L.E.).

3304 Hybrid Systems

Refer also to citation(s) 30961

3307 Emission Control

Refer also to citation(s) 31156, 31160, 31515, 31940

3308 Alternative Fuels

31163 (PB–89-163323/XAB) **Methanol Bus Program data analysis report. Interim report, September 1987-June 1988.** Krenelka, T.C.; Turanski, A.J.; Murphy, M.J. Battelle Columbus Div., OH (USA). Oct 1988. 78p. Available from NTIS, PC A05/MF A01.

The UMTA Methanol Bus Demonstration Program was established to develop information concerning safety, cost of ownership, maintainability, public health, and reliability issues resulting from the operation of methanol-fueled transit buses. The methanol demonstration started in Seattle, Washington, in September 1987 and in New York City in May 1988. The data presented in the report are analyzed for mileage, fuel consumption, oil consumption, maintenance actions, and safety/health/accident occurrences for methanol and diesel control buses operating on the same routes. The appendices provide the following information: Detailed specifications for diesel and methanol buses in the demonstration; Routes used by the fleets; Discussion of different energy contents of methanol and diesel fuels; and a Driver Survey Questionnaire. Overall, the methanol bus demonstration program is planned to involve a total of 59 methanol-fueled buses operating under a variety of operational and environmental conditions.

31164 (PB–89-165518/XAB) **Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report.** Notaro, F. Union Carbide Corp., Tonawanda, NY (USA). Linde Div. Jul 1985. 189p. Available from NTIS, PC A09/MF A01.

The New York State Energy Research and Development Authority and the New York State Gas Group completed a project assessing the potential for adsorbent-enhanced storage of compressed natural gas for dual-fuel vehicles. The report compares several carbon and zeolite adsorbents based on surface area, porosity, pore size distribution, density and methane loading; AX-21 is evaluated in detail.

The impact of low-pressure adsorptive storage safety is presented. System costs – compressor, power fill station, on-board storage – are evaluated for four reference fleets: school buses, vans, passenger sedans and compacts. Fuel economy, fleet size, adsorbent density and price are evaluated to determine the economics of adsorptive storage. An estimate of temperature increase due to the heat of adsorption and subsequent loss of adsorption capacity is made for quick-fill operations. Several potential solutions to the heat problem are analyzed.

31165 (PB–89-167472/XAB) **Development of fast-burn combustion with elevated coolant temperatures for natural gas engines. Annual report, May 1987-April 1988.** Gladden, J.R.; Kline, J.C. Caterpillar, Inc., Peoria, IL (USA). Jul 1988. 68p. Available from NTIS, PC A04/MF A01.

This is the third year of a three and one-half year program. The overall objective of the work is to improve the state of the art in the gas-fired spark-ignited engine for use in a cogeneration system. Three characteristics are in process of being enhanced for cogeneration, namely, Low-Pressure Gas Induction, Improved Shaft Thermal Efficiency, and Increased Jacket Coolant Temperature. Major accomplishments in the third year include completion of the Taguchi-designed experiments, selection of compression ratio, identification of need for flame arresters, identification of oxygen sensor, and build and installation of 3406 SI for transient emission testing.

31166 (TEMP–AF-88-02) **Evaluation of compressed natural gas conversion systems.** Topaloglu, T. Transportation Energy Management Program, Downsview, ON (Canada). 1988. 64p. (MICROLOG–88-05859). Available from Transportation Energy Management Program (TEMP), Central Building, Rm. 324, Ontario Ministry of Transportation and Communications, 1201 Wilson Ave., Downsview, ON, Canada M3M 1J8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In this report, the performance of commercial compressed natural gas (CNG) automotive conversion equipment is evaluated on fuel consumption, exhaust emissions, and acceleration performance results obtained in a chassis dynamometer laboratory. The conversion systems were installed on a 5-l spark-ignition engine in a Ford pickup truck, which was operated as a CNG/gasoline dual-fuel vehicle. Fuel consumption and exhaust emissions of hydrocarbons and NO/sub x/were measured on gasoline, before and after conversion, and on natural gas over urban and highway driving cycles, strictly according to Transport Canada guidelines and US EPA regulations. The dynamometer results indicate that the conversion systems provided comparable performances. Energy consumption with natural gas was only 2.5% higher than with gasoline during both urban and highway driving. Acceleration performance with natural gas was 15 to 20% inferior to that with gasoline, as measured over 0 to 100 km/h acceleration tests. Emissions of CO and NO/sub x/were lower with natural gas; however, hydrocarbon emissions were higher than with gasoline. Results were obtained with the original vehicle pollution control equipment in good operating order. Specific tests were conducted to quantify the effects of disabling pollution control equipment. Both measures resulted in unacceptably high exhaust emissions and no measurable benefits in either acceleration performance or fuel consumption. This program points to specific deficiencies with the present after-market conversion method: the significant losses in power and energy efficiency with conversion in both natural gas and gasoline modes. Dedicated natural gas engines are expected to mitigate these deficiencies and to enhance the attractiveness of natural gas as an alternative fuel. 15 refs., 14 figs., 14 tabs.

35 ARMS CONTROL

31167 (CONF-890692–12) **Risk associated with the demilitarization of the United States chemical weapons stockpile.** Flanagan, G.F.; Fraize, W.; Kartachak, T. Oak Ridge National Lab., TN (USA). 1989. 30p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. From 82. Air and Waste Management Association annual meeting and exhibition; Anaheim, California, USA; 25-30 Jun 1989. Order Number DE89013044/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In accordance with Public Law 99-145 (Title 14, Part B, Section 1412) a programmatic Environmental Impact Statement was prepared to assess the environmental impact of destruction of the continental US (CONUS) stockpile of unitary lethal chemical agent and munitions. The CONUS supply of chemical munitions and agents accounted for 94.4% by weight of the entire US stockpile. The CONUS stockpile is currently stored at the eight sites. The hazards associated with the disposal process included those associated with (1) plant operation, (2) transportation, (3) handling, and (4) external events (pervasive among the other 3 hazard areas). 8 refs., 9 figs., 2 tabs.

3501 Policy, Negotiations, and Legislation

31168 (AD-A–204186/1/XAB) **Defense Nuclear Agency Fiscal Year 1990/91 program document: research, development, test and evaluation, defense agencies (supports congressional budget estimates).** Lake City Army Ammunition Plant, Independence, MO (USA). Ammunition Technology Div. 15 Dec 1988. 21p. Available from NTIS, PC A03/MF A01.

This research and development program explores and develops technology to improve the nuclear survivability and effectiveness of U.S. strategic and non-strategic weapons systems and forces, and the command control and communications systems needed to operate those systems and forces in a nuclear conflict. This program is particularly responsive to the new environments of arms limitation and fiscal constraint by providing technology to create extremely reliable military systems, thereby maintaining a credible nuclear posture necessary to deter conflict. Research efforts encompass: Nuclear weapons effects; underground nuclear tests, nuclear hardening, radiation simulators, nuclear detonation effects, biomedical effects survivability.

31169 (CONF-890124–4) **Legal aspects of implementing a global chemical weapons convention under domestic laws.** Tanzman, E.A. Argonne National Lab., IL (USA). 1989. 17p. Sponsored by DOE Defense Programs. DOE Contract W-31109-ENG-38. From American Association for the Advancement of Science (AAAS) annual meeting; San Francisco, California, USA; 14-19 Jan 1989. Order Number DE89013630/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The notion that domestic law must be considered as part of the planning to implement an arms control treaty shows how far the nations of the world have come in their negotiation of such agreements. Increasingly, arms control agreements are more than simply mutual declarations of self interest. Verification provisions have made them instruments that create enforceable law which, as such, must be integrated into the existing legal structure of each State Party. Nowhere is this more obvious than in the development of international controls over chemical weapons. The Geneva Protocol of 1925 required only a single page to ban the use of chemical weapons in wartime. In contrast, the Draft Convention on the Prohibition of Chemical Weapons tabled at the Geneva Conference on Disarmament in 1984 by the United States was some thirty pages long. The most recent Rolling Text of this draft treaty now exceeds one hundred pages and still requires additional text. The vast majority of this material specifies the verification measures and the international agency, to be called the Organization for the Prohibition of Chemical Weapons, that have been deemed necessary to implement the agreement.

3502 Proliferation

Refer also to citation(s) 31164

31170 (AD-A–204286/9/XAB) **PACOM net assessment: Pakistani and Indian nuclear perceptions. Volume 1. Main report. Final report, 31 January-31 August 1983.** Simon, J. Analytical Assessments Corp., Marina Del Rey, CA (USA). 31 Aug 1983. 62p. (AAC-TR–18161/83-VOL-1-SAN). Available from NTIS, PC A04/MF A01.

See also Volume 2, AD-A197 981.

This study evaluates the significance of nuclear proliferation as seen from the perspective of the Indian and Pakistani political-military leaderships, and speculates three hypothetical 1985 scenarios.

31171 (PB–89-149447/XAB) **International Atomic Energy Agency safeguards: observations on lessons for verifying a chemical weapons convention.** Keeley, J.F. Calgary Univ., AB (Canada). Sep 1988. 76p. Available from NTIS, PC EE05/MF A01.

See also DE–86-008744.

This study examines the political, organizational, legal, financial, and technical aspects of the International Atomic Energy Agency's (IAEA) experience. The non-technical aspects focus on the significant features of both the Agency's internal structure and operations and the broader environment in which it must function. The study looks at the approach to the control problem taken by the Agency-its definition of the problem and of its own objectives - and the coverage it provides with respect to possible routes for acquisition of nuclear weapons. It considers the factors affecting the Agency's political and technical effectiveness. Recognizing that the Agency's roots lie in the promotion of the benefits of peaceful uses of atomic energy, the study examines the political base of the Agency's activities, in the power of suppliers of nuclear goods and services, and in the existence of a broad norm or presumption against the spread of nuclear weapons. It also examines some issues arising from the use of an international organization for the performance of verification tasks.

3503 Verification

Refer also to citation(s) 30631, 31171

31172 (UCRL–21205) **Ensuring effective monitoring technology for arms control verification: Final report.** Bair, A.; Hodge, J. Science Applications International Corp., McLean, VA (USA). 31 Mar 1989. 33p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012604/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The demand for monitoring technologies with applications in arms control verification has increased dramatically in recent years. Parallel to this development, however, is growing uneasiness in some quarters, particularly Congress, about whether the US government is organized in the best manner to ensure effective verification R and D for US arms control policy. Future arms control verification requirements, and the associated demand for monitoring technologies, will be determined by (1) broad national security goals; (2) the arms control agenda; (3) treaty-specific monitoring requirements; (4) verification standards; (5) intelligence capabilities; (6)resource allocation choices; and (7) the availability of safeguards. The principle driver for future verification technology demand will be treaty-specific monitoring requirements in light of US national security goals and related arms control objectives. But the other considerations will influence the specific demands for monitoring technologies – increasing, tempering, or containing what is thought to be required. 2 tabs.

36 MATERIALS

Refer also to citation(s) 30990

31173 (INIS-SU–80) **Physics of radiation defects and radiation material science. Scientific-technical collection.** Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. 81p. (In Russian). Order Number DE89012114/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3(41).

Individual papers in this collection are indexed separately.

31174 (ORNL–6529) **Metals and Ceramics Division progress report for period ending September 30, 1988.** Oak Ridge National Lab., TN (USA). Apr 1989. 200p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89012905/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report provides a brief overview of the activities and accomplishments of the Metals and Ceramics Division during FY 1988. The division is organized to provide technical support, primarily in the area of structural materials, for the various technologies being developed by the US Department of Energy (DOE). Activities include basic research, applied research, engineering development, and production of specialized materials for space power systems. Strong emphasis is placed on the development and transfer of technology to the private sector. In order to serve the needs of the different energy technologies, the division is organized in a centralized matrix structure, which makes it difficult to describe the division from any single point of view. The first four chapters of the report describe activities in the functional groups in which the research activities are conducted. Chapter 5 describes our program activities, many of which cross group and section lines. We provide field management support for DOE for several programs. In this activity, we subcontract about $12M annually to university and industrial research laboratories. The division has developed and maintains a broad array of state-of-the-art instrumentation for characterizing materials, most of which are made available to qualified university and industrial researchers through our various user programs.

3601 Metals and Alloys

Refer also to citation(s) 30295, 30426, 30566, 30771, 30821, 30839, 30865, 30869, 31269, 31339, 31340, 31666, 31749, 31816, 31880, 32786, 32787, 32797, 32802, 32804

31175 (AD-A–204162/2/XAB) **Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988.** Fine, M.E.; Weertman, J.R. Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering. 30 Nov 1988. 92p. Available from NTIS, PC A05/MF A01.

The objective of this research was to investigate two promising systems as the basis for high-temperature aluminum alloys useful to 425 C. The first is a metal-matrix composite consisting of an aluminum-magnesium alloy matrix reinforced by spinel (magnesium aluminate) particulate. The second system is $Al_3(ZrX)$, where X is vanadium or titanium dispersed in aluminum matrix. Here the lattice parameter of the $Al_3(ZrX)$ intermetallic particles nearly matches that of the matrix. Research on dilute alloys has shown a low coarsening rate for these intermetallics at 425 C. A study of aluminum alloys with a higher concentration of zirconium and vanadium was completed. The creep resistance at 410 C of the spinel composite was much better than that of the alumina composite. Extrusions containing 5 vol.% $A1_3$(V.75Zr.25) were prepared. The measured creep rate at 425 C is much lower than that of the current aluminum-iron-cerium alloys. An aluminum-vanadium intermetallic compound, however, forms at grain boundaries leading to a precipitate free zone which grows slowly at 425 C. Dilute alloys containing 1 vol.% $A1_3(ZrTi)$ were then prepared and these show more promise than the aluminum-zirconium-vanadium alloys.

31176 (AD-A–204510/2/XAB) **Effect of strain rate on the electroplastic effect in Nb.** Cao, W.; Sprecher, A.F.; Conrad, H. North Carolina State Univ., Raleigh, NC (USA). Dept. of Materials Science and Engineering. 1989. 6p. Available from NTIS, PC A02/MF A01.

Pub. in Scripta Metallurgica, Vol. 23, No. 1, 151-155(1989).

It has been found that the application of a high-density electric current pulse during the plastic deformation of metals produces an enhancement of the deformation rate in addition to that caused by the side effects of the current such as Joule heating and the magnetic pinch effect. This additional effect has been termed an electroplastic effect (EPE). Previous work of the authors showned that the EPE consists of two contributions: (a) an electron wind force proportional to the current density j and a second still unclear effect proportional to j2. The objective of this present study was therefore to investigate further the effect of the prior plastic strain rate on the EPE. Nb was chosen for this study because only limited prior work has been carried out on this bcc transition metal.

31177 (ANSTO/E–676) **Lithium compensation of GaAs.** Alexiev, D.; Tavendale, A.J. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Aug 1988. 16p. Order Number DE89616080/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Defects generated following Li diffusion into GaAs were studied by optical deep level transient spectroscopy (ODLTS) and deep level transient spectroscopy (DLTS). In an exploratory series of experiments, the effect of Li diffusion on existing trap spectra, defect generation and as a means for the compensation of GaAs was studied. The variables included diffusion temperature, initial trap spectra of GaAs and annealing periods. Detailed measurements of trap energies were made.

31178 (ANU-P–965) **Deposition techniques for the preparation of thin film nuclear targets.** Muggleton, A.H.F. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Jul 1987. 135p. Order Number DE89616019/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

This review commences with a brief description of the basic principles that regulate vacuum evaporation and the physical processes involved in thin film formation, followed by a description of the experimental methods used. The principle methods of heating the evaporant are detailed and the means of measuring and controlling the film thickness are elucidated. Types of thin film nuclear targets are considered and various film release agents are listed. Thin film nuclear target behaviour under ion-bombardment is described and the dependence of nuclear experimental results upon target thickness and uniformity is outlined. Special problems associated with preparing suitable targets for lifetime measurements are discussed. The causes of stripper-foil thickening and breaking under heavy-ion bombardment are considered. A comparison is made between foils manufactured by a glow discharge process and those produced by vacuum sublimation. Consideration is given to the methods of carbon stripper-foil manufacture and to the characteristics of stripper-foil lifetimes are considered. Techniques are described that have been developed for the fabrication of special targets, both from natural and isotopically enriched material, and also of elements that are either chemically unstable, or thermally unstable under irradiation. The reduction of metal oxides by the use of hydrogen or by utilising a metallothermic technique, and the simultaneous evaporation of reduced rare earth elements is described. A comprehensive list of the common targets is presented.

31179 (CEA-CONF–9635) **Gain measurements at 5nm in nickel like ytterbium.** Bourgade, J.L.; Combis, P.; Louis-Jacquet, M.; Thiell, G.; Naccache, D.; MacGowan, B.J.; Keane, C.J.; Matthews, D.L.; Stone, G.; Whelan, D.A. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). 1988. 4p. (CONF-880706–: International quantum electronics conference, Tokyo, Japan, 18-22 Jul 1988). Order Number DE89776487/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Soft x-ray gain has been demonstrated at 5.03 nm within a laser produced plasma of Ni-like ytterbium. Experiments will also be described with higher Z Ni-like ions which can produce even shorter wavelength x-ray laser transitions.

31180 (CEA-CONF–9702) **How to minimize wastes.** Ambolet, M. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). Oct 1988. 19p. (In French). (CONF-8810351–: Meeting on uranium, Montpellier, France, 10-12 Oct 1988). Order Number DE89760690/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Actions undertaken by the CEA to decrease the stock of natural and depleted uranium are presented in this paper. Various wastes and residues are produced in uranium fabrication. If for some wastes or residues processing methods were found previously, for other storage was the rule. Facing growing problems of safety, bulkiness, and cost new treatments allow to decrease a great amount of wastes. Uranium fabrication cycle, wastes and residues are described. Processing of the different residues of operations and optimization of manufacture are indicated.

31181 (CEA-CONF–9758) **Cascade effects in non equilibrium phase transitions with metallurgical relevance.** Bellon, P.; Martin, G. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie. 1988. 2p. (CONF-8806365–: Conference on non linear coherent structures in physics, mechanics and biological systems, Paris, France, 28-30 Jun 1988). Order Number DE89770536/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

NICKEL BASE ALLOYS/physical radiation effects; MOLYBDENUM ALLOYS/physical radiation effects; ORDER-DISORDER TRANSFORMATIONS

31182 (CONF-880602–5) **Infrared study of carbon on alumina.** Najbar, J.; Eischens, R.P. Lehigh Univ., Bethlehem, PA (USA). Zettlemoyer Center for Surface Studies. 1988. 8p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13612. From 9. international catalysis congress; Calgary, Canada; 26 Jun - 1 jul 1988. Order Number DE89013311/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Previous work showed that coking of alumina, or alumina-supported platinum and rhenium, produced bands near 1580 cm^{-1} and 1470 cm^{-1} which were assigned to carboxylates. These bands were smaller when rhenium was present, indicating that suppression of the species producing these bands might be related to the beneficial effect of rhenium in reforming catalysts. However, there is a reasonable alternative assignment that would attribute the bands to a mixture of aromatic carbon-carbon stretchings and CH_2 deformations. In the work reported here, isotopic labeling experiments, using oxygen-18 and deuterium, confirm the carboxylate assignment. 15 refs., 4 figs.

31183 (CONF-880613–31) **Effects of irradiation on K_{Ic} curves for high-copper welds.** Nanstad, R.K.; McCabe, D.E.; Menke, B.H.; Iskander, S.K.; Haggag, F.M. Oak Ridge National Lab., TN (USA). 1988. 48p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 14. international symposium on effects of radiation on materials; Andover, Massachusetts, USA; 27-29 Jun 1988. Order Number DE89012343/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Fifth Irradiation Series in the Heavy-Section Steel Technology (HSST) Program is aimed at obtaining a statistically significant fracture toughness data base on two weldments with high-copper contents to determine the shift and shape of the K_{Ic} curve as a consequence of irradiation. The program includes irradiated Charpy V-notch impact, tensile, and drop-weight specimens in addition to compact fracture toughness specimens. Compact specimens (CS) with thicknesses of 25.4, 50.8, and 101.6 mm (1TCS, 2TCS, and 4TCS, respectively) have been irradiated. Additionally, unirradiated 6TCS and 8TCS have been tested to attain the same K_{Ic} measuring capacity as the irradiated specimens. The materials for this irradiation series are two weldments fabricated from special heats of weld wire with copper added to the melt. One lot of Linde 0124 flux was used for all the welds. Copper levels for the two welds are 0.23 and 0.31 wt %, while the nickel contents are 0.60 wt %. 17 refs., 16 figs., 9 tabs.

31184 (CONF-881155–73) **Forces through epitaxially grown interfaces.** Flynn, C.P. Illinois Univ., Urbana, IL (USA). 1988. 10p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER01198. From Fall meeting of the Materials Research Society; Boston, Massachusetts, USA; 28 Nov - 3 dec 1988. Order Number DE89012407/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Experiments are described in which crystals are grown by molecular beam epitaxy to reveal the character of the forces transmitted through interfaces. Both long range forces carried by the electron liquid in metals, and short range interactions associated with atomic size and misfit, are discussed. 22 refs., 6 figs.

31185 (CONF-881155–74) **Amorphization of Zr_3Al by hydrogenation and subsequent electron irradiation.** Meng, W.J.; Koike, J.; Okamoto, P.R.; Rehn, L.E. Argonne National Lab., IL (USA). Dec 1988. 6p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Fall meeting of the Materials Research Society; Boston, Massachusetts, USA; 28 Nov - 3 dec 1988. Order Number DE89013177/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

1-MeV electron irradiation of hydrogenated Zr_3Al ($Zr_3AlH_{0.96}$) at 10K is studied. A more than 20 fold reduction in the critical dose required for complete amorphization is observed for the hydrogenated specimen as compared to the un-hydrogenated Zr_3Al under identical irradiation conditions. 11 refs., 4 figs.

31186 (CONF-890165–3) **High-resolution electron microscopy of metal/ceramic interfaces.** Merkle, K.L. Argonne National Lab., IL (USA). Mar 1989. 9p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Acta-scripta conference on metal-ceramic interfaces; Santa Barbara, California, USA; 15-19 Jan 1989. Order Number DE89012396/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In the present work we chose simple fcc metal/metal-oxide systems which have large misfits and which are not expected to form reaction layers at the interface. The interfaces are generated as matrix-precipitate boundaries. The precipitates appear as reaction products of internal reduction or internal oxidation. Several useful features are associated with these preparation methods: (1) Since the geometry of the interface can within the constraints due to the lattice mismatch freely develop, information on low energy faces may be obtained. (2) Impurity effects are minimized due to the very large total surface area of the precipitates. (3) A common low index zone axis between precipitate and matrix is often present, and, therefore, studies by HREM are possible. 14 refs., 6 figs., 1 tab.

31187 (CONF-890630–1) **Applications of ion beam processes in tribology.** Erck, R.A.; Fenske, G.R.; Erdemir, A.; Nichols, F.A. Argonne National Lab., IL (USA). [1989]. 3p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 5. international conference on tribology; Helsinki, Finland; 12-15 Jun 1989. Order Number DE89000614/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

With the use of ion-beam techniques becoming more common, there is increasing opportunity to develop new coatings and surface treatments to promote long wear life and low friction in tribological applications. Boundary and/or mixed lubrication and wear at elevated temperatures are two tribological areas that could benefit from ion beam applications. If successful these innovations would have a significant impact on the development of advanced energy conversion systems. Numerous examples of successful applications of ion-beam techniques can be found for wear applications at low and elevated temperatures; however, improvements in the field of lubrication, particularly at elevated temperatures, are sparse.

31188 (CONF-8811147–3) **High-temperature behavior of grain boundaries from embedded atom method molecular dynamics simulation.** Lutsko, J.F.; Wolf, D.; Phillpot, S.R. Argonne National Lab., IL (USA). Dec 1988. 8p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium on atomic scale calculations in materials science; Boston, Massachusetts, USA; 28-30 Nov 1988. Order Number DE89013641/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The behavior of a metallic grain boundary at high temperatures is studied using an embedded atom potential. A recently developed molecular dynamics code is used which allows the simulation of an isolated grain boundary at temperatures as high as the bulk melting point. The stability of the boundary below the melting point is studied and compared with earlier investigations which have suggested the existence of a "premelting" transition. It is found that the boundary migrates at high temperature but remains well defined up to the bulk melting point. In contrast to simulations of ideal crystals, it was not possible to superheat the grain boundary due to the nucleation of bulk melting at the boundary. 14 refs., 4 figs.

31189 (CTA-IEAv-RP–023-88) **Uranium alloys for using in fast breeder reactors.** Moura Neto, C.; Pires, O.S. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Aug 1988. 8p. (In Portuguese). Order Number DE89614481/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The U-Zr and U-Ti alloys are studied, given emphasis to the high solute solubility in gamma phase of uranium, which is suitable for using as metal fuel in fast breeder reactors. The alloys were prepared in electron beam furnaces and submitted to X-ray diffraction, X-ray fluorescence, microhardness, optical metallography, and chemical analysis. The obtained values are good agreements with the literature data. The study shows that the U-Zr presents better characteristics than the U-Ti for using as fuel in fast breeder reactors. (M.C.K.).

31190 (DOE/CE/15323–T5) **Effects of auxiliary heat treatments on flame-cutting procedures.** Somers, B.R.; Smith, H.; Varughese, R.; Pense, A.W. Lehigh Univ., Bethlehem, PA (USA). 14 Apr 1989. 31p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract FG01-87CE15323. (ATLSS–89-08). Order Number DE89011827/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

One inch and two inch thick flame-cut samples of A588 steel were prepared using three different cutting treatments including cutting with auxiliary pre and post heat, cutting with auxiliary post heat only, and cutting with no auxiliary. The auxiliary heat was applied to the cutting process using a proprietary fixture designed by Roussey Associates. Each of these cutting treatments was applied at both a fast and a slow cutting speed. Surface hardness tests showed that within the same composition and thickness the hardest flame cut surfaces occurred at the faster cutting speed when no auxiliary heat was applied. The softest surface occurred at slow cutting speeds when both pre and post heat flames were applied. Microhardness traverses show the tempering effects of the auxiliary heat. Bend tests displayed for the one inch samples with pre and post heat, at both cutting speeds, none or only very slight cracking. Numerous slight cracks, however, were found when no auxiliary heat treatment was used. While pre and post heat treatments reduced the cracking severity in the two inch plate, numerous slight cracks were still seen, even at slow cutting speeds. 6 refs., 13 figs., 5 tabs.

31191 (DOE/ER/45211–13) **Experimental studies of the structure of grain boundaries: Progress report.** Sass, S.L. Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering. Feb 1989. 15p. Sponsored by DOE Energy Research. DOE Contract FG02-85ER45211. Order Number DE89012954/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the Progress Report for the experimental research program supported by the Department of Energy under Grant No. FG02-85ER45211. The long range goals of this research project are to obtain information on the atomic structure and properties of grain boundaries in bcc metals and ceramics, to understand how solute segregation influences grain boundary structure and causes boundaries to become embrittled in Fe-base alloys, to understand the role of boron and non-stoichiometry in making brittle boundaries in Ni_3Al ductile, and to understand how solute segregation influences the boundary structure in ceramic materials. The topics covered by this report are: the influence of solute segregation on the structure of grain boundaries in Fe-base alloys; and the influence of boron segregation on the structure of grain boundaries in Ni_3Al. 21 refs., 6 figs.

31192 (DOE/ER/45255–3) **Stress corrosion cracking and metal-induced embrittlement: Local chemistry and local plasticity: Progress report, September 1, 1986–October 31, 1988.** Heldt, L.A.; White, C.L. Michigan Technological Univ., Houghton, MI (USA). Dept. of Metallurgical Engineering. Nov 1988. 37p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER45255. Order Number DE89012951/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Transgranular SCC of β brass crystals occurs on the {100} plane in the <110> direction; steps connecting the {100} facets are also {100} and apparently result from secondary cracking. Slow strain rate tests reveal a constant resolved normal stress for fracture at critical combinations of strain rate and potential. Testing of compact tension specimens resulted in measurement of a threshold stress intensity of $K_{SCC} = 4.8$ MPa $\sqrt{m}$; the crack velocity increases rapidly with K, then approaches a limiting value of about 10^{-4} mm/sec. X-ray diffraction rocking curves taken on the (100) fracture surfaces of compact tension specimens indicate extensive deformation near the fracture surface. As determined by x-ray diffraction line broadening studies on external surfaces of α brass, ammoniacal solutions cause enhanced deformation (microstrain) of the near surface region. Prestraining in air or inhibiting environment reduces subsequent ductility in the SCC environment for both α and β alloys tested at

constant strain rate. Prestrain also reduces time to failure for subsequent environmental testing at constant stress. LME of β brass crystals by gallium is characterized by a constant normal stress for fracture in slow strain rate tests. Variations in gallium thickness are seen on the fracture surfaces – menisci tend to form along surface steps. Auger analyses of specimen fractured in vacuum indicate significant point to point variations in Ga, Cu, and Zn concentrations and high surface mobility for gallium. 11 refs., 21 figs., 1 tab.

31193 (DOE/ER/45311–2) **The structure and properties of grain boundaries in B2 ordered alloys: Progress report.** Baker, I. Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering. 21 Apr 1989. 14p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER45311. Order Number DE89013266/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report covers the period from April 1st 1988 to March 30th 1989. During this period a number of fine-grained alloys of FeAl and NiAl with different aluminum contents were produced by multiple hot extrusion. Thus far, researchers have characterized the extruded microstructures of the alloys; initiated mechanical testing which confirms that with increasing deviation from stoichiometry the yield strength of FeAl decreases while that for NiAl increases and which shows the grain boundary strengthening in NiAl decreases with increasing deviation from stoichiometry; performed grain growth studies of NiAl and FeAl. For FeAl alloys it was found that grain growth is more rapid in the iron-rich composition; continued an atom probe field ion microscope (APFIM) study of the grain boundary chemistry of NiAl with Dr. M.K. Miller at Oak Ridge National Laboratory; studied boundary chemistry in near-stoichiometric NiAl and FeAl using scanning Auger electron spectroscopy at Oak Ridge National laboratory, with the aid of Mr. R.A. Padgett, Jr. and initiated in-situ straining experiments in the transmission electron microscope (TEM) to examine dislocation/grain boundary interactions. 6 figs., 1 tab.

31194 (DP-MS–88-213) **High temperature mechanical properties and microscopic examination of extruded powder aluminum.** Woods, T.O.; Berghaus, D.G.; Peacock, H.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. (CONF-8906119–1: Powder metallurgy conference, San Diego, California, USA, 11-14 Jun 1989). Order Number DE89010457/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this work is to examine the high temperature mechanical properties and structure of extruded powder aluminum so that its failure mechanisms can be determined. Specimens made from both extruded 101 ALCOA (Aluminum Company of America) powder aluminum and 1100 commercial aluminum rods were mechanically tested in simple tension, simple compression, pure torsion, and combined tension-torsion and compression-torsion loadings at a test temperature of 350°C. The varied loadings are necessary to analyze material behavior because during extrusion the material is subjected to combinations of tensile, shear, and compressive deformations. Both powder aluminum and 100 aluminum specimens were tested to that stress-strain curves from the two materials could be compared to reveal differences in material properties which are due to the laminary structure of the extruded powder material. During extrusion the powder particles form a laminar structure. This structure consist of elongated particles which are separated by aluminum oxide. The brittle oxide originally coated the pre-extruded particles. 9 refs., 4 figs.

31195 (EGG-M–88231) **Evaluation of elastic-plastic surface flaw behavior and related parameters using surface displacement measurements.** Lloyd, W.R.; Reuter, W.G. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 34p. Sponsored by DOE Energy Research. DOE Contract AC07-76ID01570. (CONF-8906114–1: 21. fracture symposium, Annapolis, Maryland, USA, 28-30 Jun 1989). Order Number DE89011134/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Surface displacement measurements, on surface cracked plate specimens loaded in tension, were recorded using geometric moire. An algorithm based on the displacements predicted by HRR fields was developed by the authors and used to evaluate the value of the applied J-integral at the crack border/free surface intersection point at various levels of applied remote stress. The values of J calculated in this manner were found to be in good agreement with predictions by Parks, obtained from a nonlinear, 3-D finite element model (ABAQUS). 8 refs., 9 figs., 1 tab.

31196 (EMR/MTL–88-4) **Effects of attachment thickness and weld profile on fatigue life of welded joints.** Vosikovsky, O.; Bouchard, R.; Rivard, A. Canada Centre of Mineral and Energy Technology, Ottawa, ON (Canada). Metals Technology Labs. 1988. 25p. (MICROLOG–89-00489). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Results are presented from an exploratory experimental program on evaluation of effects of smaller attachment thickness and improved weld profile (concave shape achieved by welding as per American Welding Society D 1.1-86 Code) on the fatigue life of load-carrying welded joints with transverse welds. Such joints are used in offshore structures. It was found that the reduced attachment thickness and the concave weld profile provide significant improvements only in long lives. For 52 mm thick plate welded T-joints the reduction in attachment thickness by one half increased fatigue life at stress range of 100 megapascals by 50-80%. The improved weld profile on joints with 26 mm thick attachments doubled the fatigue life. 19 refs., 6 figs., 5 tabs.

31197 (IEN-DEMA–003/80) **Explanations on nomenclature and number of material for steels in accordance with DIN norm - (Deutsch Industrie Norm).** Barone, S.D.; Silva, T.C.V. da; Bittencourt, M.S.Q. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). 1980. 20p. (In Portuguese). Order Number DE89614718/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The materials specified by DIN norm are identified by its nomenclature and corresponding DIN number. The characters (numbers and letters) aim to classify the material and provide indication on main alloy properties and elements. (M.C.K.).

31198 (IKE–2-84) **Attempts at modelling the processes of gas- and water-atomization for the production of metal powders.** Song-Hak Cho. Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme. Dec 1988. 77p. (In German). Order Number DE89774667/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Among the methods of production of metal powders gas- and water-atomization are of great importance. Nevertheless the plant and performance data are still adjusted by means of empirical correlations, as the basic mechanisms of the atomization processes have not been fully understood yet. In the frame of the present study it is investigated, whether the stripping process of unstable capillary waves in parallel flow configuration can be regarded as an essential mechanism of atomization. For this purpose the theoretical models in the literature to this subject have been compiled and compared concerning the mean parameters influencing fragment size. These mean parameters are the relative velocity between the media, the density of the atomizing medium as well as the density and the surface tension of the melt.

31199 (INIS-BR–1443) **Contribution to the study of zinc and cadmium diffusions in InP and In/sub 0,97/Ga/sub 0,03/As/sub 0,08/P/sub 0,92/quaternary compound.** Tesser Junior, N.L. Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica. 1986. 77p. (In Portuguese). Order Number DE89616020/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The zinc and cadmium diffusions in In/sub 0,97/Ga/sub 0,03/As/sub 0,08/P/sub 0,92/and InP, using sealed blister method, are studied. The consequences of fick law in diffusion processes are analysed. The diffusion measuring methods and carried out adjustments are described. (M.C.K.).

31200 (INIS-BR–1458, pp. 211) **Radiation effects on metals, alloys and cement.** Lucki, G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4.*

International Symposium on Radiation Physics - Abstracts. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALLOYS/physical radiation effects; CEMENTS/physical radiation effects; METALS/physical radiation effects; ALLOYS; ALPHA PARTICLES; CEMENTS; CYCLOTRONS; FAST NEUTRONS; IEAR-1 REACTOR; ION IMPLANTATION; IRRADIATION; METALS; PHYSICAL PROPERTIES

31201 (INIS-BR–1459) **Fatigue life prediction for a cold worked T316 stainless steel.** Manjoine, M.J. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 10p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89613286/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Permanent damage curves of initiation-life and propagation-life which predict the fatigue life of specimens of a cold-worked type 316 stainless steel under complex strain-range histories were generated by a limited test program. Analysis of the test data showed that fatigue damage is not linear throughout life and that propagation life is longer than initiation-life at high strain ranges but is shorter at low strain ranges. If permanent damage has been initiated by prior history and/or fabrication, propagation to a given life can occur at a lower strain range than that estimated from the fatigue curves for constant CSR.

31202 (INIS-BR–1460) **Hydrogen induced surface effects on the mechanical properties of type 304 stainless steel.** Silva, T.C.V. da; Pascual, R.; Miranda, P.E.V. de. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 10p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89613287/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The possibilities of modifying the mechanical properties of type 304 stainless steel by cathodic hydrogen charging were studied. The situations analysed included hydrogen embrittlement itself in tensile tests of hydrogen containing samples and the effects of delayed cracks in fatigue tests of hydrogenated and outgassed samples. SEM and TEM observations were also performed. It was found that hydrogen induced surface delayed cracks appear in great quantity during outgassing (of the order of several millions in a square centimeter). Hydrogen embrittlement was responsible for drastic losses in ductility in tension, while surface cracks severely reduced fatigue life.

31203 (INIS-BR–1461) **Temperature dependence of the fracture in austenitic stainless steels.** Monteiro, S.N.; Almeida, L.H. de. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 10p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89613288/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

An extensive investigacion on the temperature dependence of the fracture in tensile tests was carried out from - 196 to 800/sup 0/C in types, 302, 304, 310 and 316 austenitic stainless steels. It was found that a low temperatures the metastable steels undergo martensitic transformation which interferes with the fracture process resulting in ductility maxima and minima. At high temperature the ductile fracture aspects and necking profile show evidence of dynamic strain aging as well as carbide precipitation effects.

31204 (INIS-BR–1463) **Iodine stress corrosion cracking in Zircaloy.** Andrade, A.H.P. de; Pelloux, R.M.N. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 9p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89613289/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The subcritical growth of iodine-induced cracks in unirradiated Zircaloy plates is investigated as a function of the stress intensity factor K. The testing variables are: crystallographic texture (f-Number), microstructure (grain directionaly), heat treatment (stress relieved vs recrystallized plate), and temperature. The iodine partial pressure is 40Pa.

31205 (INIS-BR–1464) **Ductile crack growth in nuclear austenitic stainless steel plates: influence of crack orientation and steel microstructure.** Balladon, P; Heritier, J. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 10p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89613247/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Fracture toughness at room and elevated temperature of wrought austenitic stainless steels used for the fabrication of pressurised water reactors and liquid metal fast breeder reactors is determined by mean of J-R curve analysis. The influence of microstruture, second phases in the austenitic matrix and crack orientation is examined.

31206 (INIS-BR–1466) **Dynamic fracture behavior of nodular cast iron.** Bradley, W.L. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 10p. (CONF-8311130–: International conference on fracture prevention in energy and transport systems, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1983). Order Number DE89613290/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Ferritic nodular cast iron has been found to be a much tougher material than previously believed based on Charpy impact test results. As a result this material is being considered as a substitute for Stainless Steel in nuclear waste transport containers. We have determined K/sub Ic/and K/sub Id/values for nodular cast iron with varying values of silicon and percentage of pearlite in the matrix. Regular V-notch charpy bars and fatigue precracked charpy bars have been tested to determine the initiation and propagation energy and the effect of notch acuity on transition temperature.

31207 (INIS-BR–1483, pp. 15) **Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices.** Iikawa, F. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Motisuke, P.; Sacilotti, M.A. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ARSENIC/gallium; ARSENIC/indium; ARSENIC/superlattices; GALLIUM/arsenic; GALLIUM/indium; GALLIUM/superlattices; GALLIUM ARSENIDES/substrates; GALLIUM ARSENIDES/superlattices; INDIUM/arsenic; INDIUM/gallium; INDIUM/superlattices; SUPERLATTICES/annealing; SUPERLATTICES/crystal growth; SUPERLATTICES/optical properties; ARSENIC; GALLIUM; INDIUM; SUPERLATTICES; CHEMICAL VAPOR DEPOSITION; SUBSTRATES; LAYERS; QUANTITY RATIO; RAMAN SPECTRA; RECOMBINATION; ANNEALING

31208 (INIS-BR–1483, pp. 95) **Preparation and characterization of ohmic contacts to n-GaAs and p-GaSb.** Oliveira, J.B.B. (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Olivieri, C.A.; Galzerani, J.C.; Pasa, A.A.; Cardoso, L.P. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SEMICONDUCTOR MATERIALS/electric conductivity; SEMICONDUCTOR MATERIALS/sample preparation; SEMICONDUCTOR MATERIALS/x-ray diffraction; ANNEALING; ANTIMONY; ARSENIC; AUGER ELECTRON SPECTROSCOPY; GALLIUM; INTERFACES; RUTHERFORD SCATTERING; TEMPERATURE DEPENDENCE

31209 (INIS-BR–1521) **Influences of deformation velocity and temperature on localized deformation of zircaloy-4 in tensile tests.** Boratto, F.J.M. Minas Gerais Univ., Belo Horizonte (Brazil). 1973. 99p. (In Portuguese). Order Number

DE89613291/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

A new parameter to describe the necking stability in zircaloy-4 during tensile tests is introduced. The parameter is defined as: s = ∂Ln ($d\sigma/d\epsilon$)/∂Ln ((1/L)dL/dt) for constant temperature, deformation and history. Measures of stress strain rate sensitivity n, reduction of the area at fracture, and deformation profiles of tensile fracture, are done. A complete description of the curve of non-uniform deformation variation with the temperature, is presented. The results are compared with existing data for pure commercially titanium. The influence of strain rate and history on s and n parameters, in the temperature range from (100-700/sup 0/C).

31210 (INIS-BR–1529) **Plastic behaviour of zircoloy-4 sheets in function of the temperature.** Ordonez, S.; Marxsen, A.; Pochettino, A.; Vedoya, P. Associacao Latino-Americana de Metalurgia e Materiais, Rio de Janeiro, RJ (Brazil). 1988. 8p. (In Spanish). (CONF-8811214–: 3. Latin-American colloquium about fatigue and fracture of materials, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1988). Order Number DE89616060/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In order to the knowledge of plastic deformation mechanisms in Zry-4 thin sheets at high temperature and the effects that the interaction sample-oxidizing atmosphere induces on these mechanisms, a systematic study of the mechanical behaviour of the material in the temperature range 400 '<=' T '<=' 800/sup 0/C and under different oxidations contitions is present.

31211 (INIS-SU–80, pp. 16-20) **Grain boundary strength as point defect sink strength.** Volobuev, A.V. (AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Gann, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Physics of radiation defects and radiation materiss science. Scientific-technical collection.* Order Number DE89012114/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3(41).

Sink strength of spherical grain boundary as an absolutely absorbing surface and as finite thickness wall consisting of the edge dislocations are considered. The values of the grain boundary sink strength are shown to be critically dependent on the point defect recombination degree. 1 ref.; 4 figs.

31212 (INIS-SU–80, pp. 3-15) **Recombination zone of Frenkel pairs in metals.** Pechenkin, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Kaipetskaya, E.N.; Konobeev, Yu.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). In *Physics of radiation defects and radiation materials science. Scientific-technical collection.* Order Number DE89012114/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3(41).

The literary data on recombination zone of Frenkel pairs in metals are reviewed. Theoretical results obtained by computerized simulation and in frames of diffusion theory taking account of elastic interaction of vacancies and interstitials are considered. Experimental data on the recombination zone size obtained by measuring electric conductivity of metals under irradiation, investigations of stage I of properties recovery, study of radiation-stimulated diffusion are analysed. 57 refs.; 6 figs.; 3 tabs.

31213 (IPEN-PUB–232) **Radiation effects on metals, alloys and cement.** Lucki, G.; Sciani, V. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Dec 1988. 41p. Order Number DE89613340/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

High - energy particle irradiation of materials brings as a consequence changes in their atomic structures that alter the electrical, magnetic and mechanical properties which are the most important characteristics for practical applications of metals and alloys. A review is made on experimental results of in-pile (IEA-RI reactor) and CV-28 cyclotron irradiated materials. Resistivity measurements on CuPd and FeNi alloys showed different behaviour during fast neutron irradiation. While CuPd had almost coincidental relaxation curves, FeNi presented a distinguishable short and long-range ordering with the critical order-disorder temperature at 515/sup 0/C. Vacancy supersaturation curves of FeNiSi (49-49-2 at %), FeNiCr (49-95-49, 95-0,1 at. %), FeNiMo (50-50 at.% + 50 ppm) and pure FeNi (50-50 at.%), determined by means of the Magnetic After Effect are presented as an effective pre-selection method of nuclear materials before the destructive stage of void formation and swelling. A displacement of damage peak from 480 to 500 and 570/ sup 0/C was detected on pure AISI 321 stainless steel and with 0,05 wt.% and 0,10 wt.% of Nb additions by means of resistivity and micro-hardness. Ultrasound techniques applied to fast neutron irradiated portland cement paste (fluence 7,2 x 10/sup 18/n/cm/sup 2/) showed a 24% decrease in its dynamic elasticity modulus. Helium diffusion on Au, Ag and Al foils irradiated in cyclotron was studied, suggesting a vacancy mechanism for single He atom diffusion. Embrittlement by Alpha particle implantation in cyclotron to simulate in-pile (n,α) reaction-was measured by high temperature creep on AISI 316 stainles steel.

31214 (Juel–2243) **Verification of constitutive equations for application at 850/sup 0/C, using the internal stress concept.** Funke, T.; Cords, H.; Nickel, H.; Schuster, H. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe; Technische Hochschule Aachen (Germany, F.R.). Nov 1988. 151p. (In German). Order Number DE89774822/JAW. Available from NTIS (US Sales Only), PC A08/MF A01.

Dissertation submitted by T. Funke.

The applicability of various constitutive equations for describing the mechanical deformation behaviour of the nickel-base alloy NiCr22 Co12 Mo at 850/sup 0/C under creep and LCF loading has been investigated. The constitutive equations considered were the simple Norton power equation for creep, the Norton equation modified by incorporating a simple approach for an internal stress, the 'unified model' equations developed by Krempl, by Miller and by Cords. The internal stress acting during stress-strain hysteresis loops was derived from a series of relaxation tests which were started at different strain values with periods of cyclic stressing between. The internal stress concept accounts satisfactorily for a number of effects that are observed in the relaxation tests which follow LCF loading. The Norton equation modified by the internal stress shows a better description of the stress-strain hysteresis loop than the unmodified version. The Krempl constitutive equation, in the version used, is not applicable for description of the mechanical behaviour of NiCr22 Co12 Mo at 850/sup 0/C. The constitutive equations developed by Cords and by Miller give a good description of the reactions of the material on specific types of loading, but significant differences between the results from the models and the experimental results are still observed. An important reason for these differences is the value of the internal stress used in these equations.

31215 (LA–11543-C) **Minutes of the meeting, Metal Forming Modeling Subgroup of IMOG, February 1988.** Logan, R.; Guerra, F. (comps.). Los Alamos National Lab., NM (USA). May 1989. 329p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-880259–Summ.: Metal forming modeling (MFM) subgroup of IMOG, Los Alamos, New Mexico, USA, 23-25 Feb 1988). Order Number DE89011401/JAW. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

The second meeting of the Metal Forming Modeling (MFM) Subgroup of IMOG was held at Los Alamos National Laboratory, February 23–25, 1988. The Metal Forming Subgroup originated from members of the Interagency Metal Forming Working Group (IMFWG) that was established in 1984, with a common interest in improving metal forming within the DOE complex via computer modeling. The topics of the presentations ranged from practical applications to constitutive models, experiments, numerical methods, and code development. The first meeting day comprised presentations from the production facilities, the national laboratories and the keynote address. The second day consisted of presentations from the national laboratories, the results of a software usage survey in

the Nuclear Weapons Community and a tour of the Bradbury Science Museum. The last day consisted of informal discussions and classified presentations. The conference is briefly summarized in an overview, followed by the meeting agenda and abstracts and vugraphs of most of the presentations. Forty-seven people attended the meeting, and a list of attendees is included. Individual projects are processed separately for the data bases.

31216 (LA–11588-MS) **Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking.** Follansbee, P.S. Los Alamos National Lab., NM (USA). Jun 1989. 12p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-36. Order Number DE89013655/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The strain-rate and temperature dependent plasticity model of Bammann, as implemented in the PRONTO FEM code, is compared with the model of Kocks and Mecking. It is shown that simplified versions of both models can be directly compared. Both models separate the temperature and strain-rate dependent yield stress (in a well annealed condition) from the temperature and strain-rate dependent strain hardening contribution. Equations are derived for the conversion from parameters describing a fit of data to the Kocks and Mecking model to parameters describing a fit to the Bammann model. The application of the results to measurements in U-0.75 Ti and a W-Ni-Fe alloy is presented. 7 refs., 5 figs., 2 tabs.

31217 (NAGRA-NTB–86-24) **Investigations of hydrogen generation by iron corrosion under repository conditions.** Schenk, R. Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland). Nov 1988. 43p. (In German). Available from Nagra, CH-5401 Baden, Switzerland.

Cast steel (GS-40) is being evaluated as a potential material for high-level waste canisters; in a repository environment, these canisters will be required to isolate the vitrified waste from contact with the groundwater for at least 1000 years. Corrosion studies to date have indicated that the behaviour of the unalloyed steel is suitable in this respect. If, in the absence of oxygen, (anaerobic repository), water is the only oxidising agent present, the corrosion rate of unalloyed steel can drop to the order of 1 micrometer/year (1 μm.a/sup -1/) or < 0.1 μm.a/sup -1/; metal loss is therefore negligible in this situation. Interest is in this case focussed on the corrosion products: (1) Hydrogen, which is produced in equivalent proportions to corroded iron according to the equation Fe + 2 H/sub 2/O –> Fe(OH)/sub 2/+ H/sub 2/and must be taken into consideration in repository safety analysis; (2) Iron oxides and salts in the form of passive films or protective layers which can promote low corrosion rates. In this study, gas chromatography was used to measure hydrogen formation to 0.01 millilitres (STP) per square metre of iron surface per hour (0.01 ml(H/sub 2/).m/sup -2/.h/sup -1/) and corrosion rates to 0.04 μm.a/sup -1/. In addition to the reference groundwaters from Boettstein and Saeckingen, steel samples were tested in media with varying Cl/sup -/-content and pH value at different temperatures. 17 refs., 13 figs., 7 tabs.

31218 (NSS/R–126) **Progress in the assessment of the corrosion of low and intermediate level waste containers under repository conditions.** Marsh, G.P. United Kingdom Nirex, Ltd., Harwell (UK). Aug 1988. 44p. Order Number DE89616100/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report describes the methodology which has been developed to assess the long term corrosion of carbon steel and austenitic stainless steel containers for LLW and ILW under repository conditions. In the case of carbon steel the objective is to estimate the metal thickness required as a corrosion allowance in order to attain a container life of up to 300 years. With the stainless steel the aim is to prove their corrosion resistance over the same life-span. Results are reported which given confidence that both classes of steel may be used to produce containers which will last beyond 300 years. Furthermore the level of confidence in this prediction is expected to be increased by the corrosion data which will be obtained in the final year of the current research programme.

31219 (ORF–57-10480) **Effect of CO/sub 2/on seamless and tubular goods.** Tyrer, J.D.; Lo, S.H.; Lassau, R.T. Ontario Research Foundation, Sheridan Park, ON (Canada). 1987. 71p. (MICROLOG–89-01949). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The purpose of this study was to investigate the corrosion resistance to high temperature (100/sup 0/C-150/sup 0/C) CO/sub 2/ brine solutions of seamless and electrical resistance welded (ERW) downhole tubular carbon steels as used in enhanced oil recovery. The study indicated that corrosion was minimal (<0.5mm) for all steel grades in the 100-150/sup 0/C temperature range. Corrosion attack was uniform with no evidence of selective microstructural attack. The ERW samples showed no evidence of excessive corrosion attack at the weld or heat affected zones. Minimal corrosion of all steel grades was due in part to the formation of a hard, crystalline impermeable siderite, FeCO/sub 3/, film on the metal surface. The presence of this film protected the steel surfaces from further corrosion. In addition, it was demonstrated that sodium bicarbonate, NaHCO/sub 3/, and calcium chloride, CaCl/sub 2/, can potentially inhibit corrosion in aqueous CO/sub 2//brine solutions. It is suggested that a program be developed to determine the ability of NaHCO/sub 3/and CaCl/sub 2 to inhibit corrosion of carbon steel materials in H/sub 2/S/CO/sub 2/brine solutions. 4 refs., 19 figs., 18 tabs.

31220 (ORF–57-10731) **Effect of CO/sub 2//H/sub 2/S on seamless and ERW tubular goods.** Tyrer, J.D.; Lo, S.H.; Lassau, R.T. Ontario Research Foundation, Sheridan Park, ON (Canada). 1988. 67p. (MICROLOG–89-01949). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This document presents the results from a corrosion investigation directed towards determining the corrosion rates and metallurgical effects on electrical resistance welded and seamless tubular carbon steel coupons. The steel was the type of material used in tubular goods utilized in the oil and gas industry, and experiments were carried out by exposing the coupons to aqueous carbon dioxide/hydrogen sulfide/brine environments in the 100-150 degree C range. Metallographic examinations were carried out to study the effects of corrosion in detail. The results indicate conclusions as follows. The presence of hydrogen sulfide at levels in excess of 10 mole % of the CO/sub 2//H/sub 2/S phase produces corrosion rates for carbon steels that are noticeabley higher than those produced in a carbon dioxide/brine environment. Increases in H/sub 2/S gas phase concentrations from 10 to 50 mole % increase corrosion rates by a factor of 2-3 in brine solutions where bicarbonate and bivalent Ca ions were absent. Those ions can potentially reduce corrosion in H/sub 2/S/CO/sub 2/brine solutions. Corrosion of carbon steels in such solutions saturated with hydrogen sulfide is a result of oxidation of the metal by H/sub 2/S; carbon dioxide may not contribute significantly to the corrosion process through direct participation. The corrosion rates of the seamless and welded grades of steel were similar. This implies that differences between the materials due to chemistry, heat treatment and the inclusion of welds were not significant enough to distinguish them by their corrosion behavior under the experimental conditions in this study. General corrosion was the only type of corrosion observed. 2 refs., 26 figs., 14 tabs.

31221 (ORNL/Sub–86-95900/01) **Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C.** Vedula, K. Oak Ridge National Lab., TN (USA). 1 Mar 1989. 24p. Sponsored by DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE89011873/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Fe-25wt%Cr, Fe-25wt%Cr-20wt%Ni and Fe-25wt%Cr-6wt%Al alloys have been exposed to $H_2/H_2O/H_2S$/Ar gas mixtures at 700°C. The mechanisms of formation and degradation of oxide scales on these alloys have been investigated using electron microscopy and surface analytical techniques. The Fe-25Cr-6Al alloy is attacked the least as a result of the formation of a Al_2O_3 layer in the scale, whereas the Fe-25Cr-20Ni alloy is attacked the most, through rapid formation of Fe and Ni sulfides. The Fe-25Cr alloy, forms a Cr_2O_3 scale containing $CrS_{1.17}$ precipitates, and other phases which eventually lead to scale breakdown. 17 refs., 8 figs., 3 tabs.

31222 (PB–89-859789/XAB) **Thermal-barrier coatings: coating methods, performance, and heat-engine applications. July 1982-April 1989 (Citations from the EI Engineering Meetings data base). Report for July 1982-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 57p. Available from NTISPC N01/MF N01.

This bibliography contains citations from conference proceedings concerning coating methods, performance evaluations, and applications of thermal-barrier coatings as protective coatings for heat-engine components against high temperature corrosions and chemical erosions. The developments of thermal barrier-coating techniques for high performance and reliable gas turbines, diesel engines, jet engines, and internal combustion engines are presented. Topics include plasma-sprayed-coating methods, yttria-stabilized zirconia coatings, coating-life models, coating failure and durability, thermal shock and cycling, and acoustic-emission analysis of coatings. (Contains 101 citations fully indexed and including a title list.)

31223 (PB–89-860274/XAB) **Micro-alloying of steels. February 1977-April 1989 (Citations from the COMPENDEX data base). Report for February 1977-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 44p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning production techniques, performance, and applications of microalloyed steels. Various microalloying materials are examined including niobium, vanadium, titanium, niobium/vanadium, aluminum, boron, molybdenum, and zirconium. Microalloying effects on the mechanical properties, corrosion resistance, metallurgical properties, and hot plasticity of steels are presented. Applications of microalloyed steels in the construction-steel industry, physical properties of microalloyed steels, low-temperature service behavior, weldability, formability, and resistance to corrosion are discussed. (Contains 81 citations fully indexed and including a title list.)

31224 (PNL-SA–15956) **Radiation effects on time-dependent deformation: Creep and growth.** Simonen, E.P. Pacific Northwest Lab., Richland, WA (USA). Mar 1989. 40p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-880901–20: Metallurgical Society fall meeting and American Society for Metals materials week, Chicago, Illinois, USA, 24-30 Sep 1988). Order Number DE89011837/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Observations of irradiation creep strain as well as irradiation growth strain and related microstructures are reviewed and compared to mechanisms for radiation effects on time-dependent deformation. Composition, microstructure, stress and temperature affect irradiation creep less than thermal creep. Irradiation creep rates can often dominate thermal creep rates, particularly at low temperatures and low stresses. Irradiation creep mechanisms are classified in two general categories: (1) stress-induced preferential absorption and (2) climb-glide. In the former, creep results from dislocation climb, whereas in the latter, creep results from dislocation glide. The effects of irradiation creep on failure modes in nuclear environments are discussed. 53 refs., 18 figs., 1 tab.

31225 (RFP–4329) **Effects of multiple reductions on grain refinement during hot working of alloy 718.** Mataya, M.C.; Matlock, D.K. Rockwell International Corp., Golden, CO (USA). 1989. 24p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP03533. (CONF-890646–4: International symposium on alloy 718 metallurgy and applications, Pittsburgh, Pennsylvania, USA, 12-14 Jun 1989). Order Number DE89010426/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The simulation of microstructural evolution during primary breakdown of production sized alloy 718 ingots by radial forging was accomplished via multiple stroke axial compression testing of cylindrical specimens taken from a wrought and heat treated bar with a 254μm grain size. Four stroke compression heat sequences were performed at a constant true strain rate of 1.0 s^{-1} and at temperatures of 950°C, 1050°C, and 1150°C. The applied strain per stroke for each four stroke sequence was either 0.14 to 0.23. Static, rather than dynamic, recrystallization was found to be responsible for the observed grain size refinement and its repetitive occurrence during back to back dwell periods resulted in the maintenance of a fine grain microstructure during multiple pass deformation sequences. In order of importance, the critical hot working parameters for recrystallization are temperature, dwell time between passes, and strain per pass. Microstructure was found to vary with work piece position, simulated by the applied sequence of dwell periods. 9 refs., 17 figs., 7 tabs.

31226 (RFP–4330) **The hot deformation behavior of an as-cast alloy 718 ingot.** Weis, M.J.; Mataya, M.C.; Thompson, S.W.; Matlock, D.K. Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. 1989. 20p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP03533. (CONF-890646–3: International symposium on alloy 718 metallurgy and applications, Pittsburgh, Pennsylvania, USA, 12-14 Jun 1989). Order Number DE89010427/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The hot deformation characteristics of an as-cast 406mm diameter vacuum induction melted-vacuum arc remelted alloy 718 ingot were investigated as a function of strain, strain rate, and temperature with high temperature compression tests between 950°C and 1150°C. The compression data exhibited a peak in the flow stress followed by extensive strain softening at low temperatures and essentially constant flow stresses at high temperatures. The observed transition in deformation behavior was attributed to the effects of temperature on strain softening mechanisms, primarily dynamic recovery, adiabatic heating and its effects on dynamic recovery, and shear band formation. The data suggest that hot working in the temperature range of 1050–1150°C will enhance uniform breakdown through larger sections. Microstructural analysis with both light and electron microscopy, showed that limited dynamic recrystallization occurred. The results are analyzed to identify mechanisms for microstructural refinement in cast ingots. 26 refs., 17 figs.

31227 (SAND–89-0264C) **The solidification metallurgy of Alloy 718 and other Nb-containing superalloys.** Cieslak, M.J.; Knorovsky, G.A.; Headley, T.J.; Romig, A.D. Jr. Sandia National Labs., Albuquerque, NM (USA). 1989. 22p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890646–1: International symposium on alloy 718 metallurgy and applications, Pittsburgh, Pennsylvania, USA, 12-14 Jun 1989). Order Number DE89008196/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The solidification behavior of Alloy 718 and other Nb-bearing austenitic superalloys has been examined using an integrated analytical approach. All alloys of this type begin solidification with the formation of Nb-lean austenitic dendrites. Interdendritic eutectic-type solidification constituents involving MC-type carbides and a Nb-rich Laves phase occur in these alloys. The γ/Laves eutectic constituent terminates solidification in these alloys. Nb is the dominant element in the evolution of solidification microstructure with C and Si affecting the amounts of γ/MC and γ/Laves constituent observed. Simple solidification models predict reasonably well the amount of eutectic constituent observed. 11 refs., 9 figs., 2 tabs.

31228 (SAND–89-0489) **Basic Energy Sciences Materials Sciences programs: FWP executive summaries.** Vook, F.L.; Samara, G.A. Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 55p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89012247/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The goals of our Basic Energy Sciences (BES) Materials Science Program at Sandia are: (1) Perform basic, forefront interdisciplinary research using the capabilities of several organizations. (2) Choose programs broadly complementary to Sandia's weapons laboratory mission, but separably identifiable. (3) Perform research in a setting which enhances technological impact because of Sandia's spectrum of basic research, applied research and development engineering. (4) Use large, capital-intensive research facilities not usually found at universities. The BES Materials Science program at Sandia Albuquerque has the central theme of Scientifically Tailored Materials. The major objective of this program is to combine Sandia's expertise and capabilities in the areas of solid state sciences, advanced atomic-level diagnostics, and materials-processing science to produce new classes of tailorable materials for the US energy industry, the electronics industry and for defense needs. Current research in this program includes ion-implantation-modified materials, physics

and chemistry of ceramics, tailored surfaces for materials applications, strained-layer semiconductors, chemical vapor deposition, surface photo kinetics, organic and high-temperature superconductors, advanced growth techniques for improved semiconductor structures and boron-rich very high temperature semiconductors.

31229 (SAND–89-0676C) **Vacuum arc remelting of Alloy 718.** Zanner, F.J.; Williams, R.L.; Harrison, R.P.; Flanders, H.D.; Thompson, R.D.; Szeto, W.C. Sandia National Labs., Albuquerque, NM (USA). 1989. 17p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890646–2: International symposium on alloy 718 metallurgy and applications, Pittsburgh, Pennsylvania, USA, 12-14 Jun 1989). Order Number DE89009069/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Vacuum arc remelting (VAR) is the principal secondary melting process used to produce ingots for almost all wrought Alloy 718 applications. We will attempt, with this paper, to summarize our previous work along with other unpublished work as it applies to VAR of Alloy 718. Successful application for a particular alloy/ingot diameter combination is believed to be dependent on achieving quasisteady thermal/solutal conditions at the solidification interfaces. Local thermal environment is strongly influenced by fluid flows which in turn are driven by global temperature gradients (convection) and magnetohydrodynamic (MHD) forces created by the arc's current distribution. Quasisteady conditions are enhanced when the metal vapor arc is stabilized in the diffuse mode where it provides optimal melting efficiency, macrouniform heating, and axisymmetrical fluid flows in the molten pool atop the ingot. Furnace conditions of low ambient gas pressures (<0.01 torr) and short electrode gaps (<10 mm) stabilize the diffuse mode. A transition from convective to magnetically dominant fluid flow occurs in the pool atop the ingot between 6.6 and 7.6 kA for production size ingots. Constricted arcs are stabilized at elevated ambient gas pressures and electrode gaps. Under these arc conditions fluid flows become unsymmetrical with respect to the ingot axis, "shelf" forms on portions of the ingot periphery, and melting efficiency is decreased. 19 refs., 13 figs.

31230 (UnB-FIS–09/88) **Optical investigation of atomic steps in ultra-thin InGaAs/InP quantum wells grown by vapor levitation epitaxy.** Morais, P.C.; Cox, H.M.; Bastos, PL.; Hwang, D.M.; Worlock, J.M.; Yablonovitch, E.; Nahory, R.E. Brasilia Univ., DF (Brazil). Dept. de Fisica. Sep 1988. 16p. Order Number DE89613257/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Ultra-thin InGaAs/InP single-quantum-well structures, grown by chloride transport vapor levitation epitaxy, have been investigated by low temperature photoluminescence (PL). Well resolved peaks are observed in the PL spectra which we attribute to monolayer (a/2=2.93 A) variations in quantum well (QW) thickness. Separate peak positions for QW thicknesses corresponding to 2-6 monolayers have been determined, providing an unambiguous thickness calibration for spectral shifts due to quantum confinement. The PL peak corresponding to two monolayers occurs at 1.314 eV corresponding to an energy shift of 524 meV. Experimental data agree very well with a simple effective-mass theory.

31231 (UnB-FIS–11/88) **InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport.** Cox, H.M.; Morais, P.C.; Hwang, D.M.; Bastos, P.; Gmitter, T.J.; Nazar, L.; Worlock, J.M.; Yablonovitch, E.; Hummel, S.G. Brasilia Univ., DF (Brazil). Dept. de Fisica. Sep 1988. 7p. Order Number DE89613258/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A variety of InGaAs/InP quantum structures have been grown by vapor levitation epitaxy (VLE) and investigated by low temperature photoluminescence (PL). Excellent long-range uniformity of QW peak positions across a two-inch diameter wafer is achieved. Monolayer thickness variations in single QW's are used to establish an essentially unambiguous correlation of QW thickness with energy upshift for ultra-thin quantum wells. PL evidence is presented of the growth, for the first time by any technique, of an InGaAs/InP QW of single monolayer thickness (2.93 (angstrom)). Quantum wires were fabricated entirely by VLE as thin as one monolayer and estimated to be three unit cells wide.

31232 (WIC–RC262/4/88) **Weld overlay disbonding.** Lazor, R.B.; Leewis, K.G. Welding Inst. of Canada, Oakville, ON (Canada). 1988. 105p. (MICROLOG–89-01719). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The overall objective of this research was to examine weld overlay procedures that minimize the occurrence of hydrogen-induced disbonding in reactor vessels. Such vessels use Cr-Mo steel in the reactor walls and are used for high temperature hydrotreatment of heavy oils or bitumen. A secondary objective was to examine the variability in overlay deposits between fabricators. Weld overlay specimens were prepared by five fabricators with the same baseplate, overlay material, and nominal welding procedures. The overlays were subjected to postweld heat treatment. Disbonding coupons were prepared from the overlay plates and were subjected to autoclave tests whose main objective was to develop a procedure which would produce repeatable disbonding. After autoclave exposure, the samples were examined ultrasonically, and metallographic, microscopic, and chemical analyses were also performed. The experimental results and observations support conclusions as follows. All fabricators produced clad deposits which were relatively similar despite small variations in weld procedures. The autoclave test procedure that was developed showed that it could produce disbonding similar to that observed in practice. The presence of hydrogen in the autoclave atmosphere was necessary to produce disbonding. Lower carbon in the baseplate reduced carbon diffusion and the risk of those microstructures associated with disbonding. Strong carbide forming elements also helped reduce susceptibility to disbonding. The high heat input from the cladding procedure had a number of thermally induced disadvantages. Recommendations are made to replace the welding procedure used. 33 refs., 64 figs., 21 tabs.

31233 Thermodynamics of metallic solids and fluids from molecular dynamics. Straub, G.K. (Los Alamos National Lab., Los Alamos, NM (US)). v.v of Computer simulation in materials science. Arsenault, R.J.; Beeler, J.R.; Esterling, D.M. American Society for Metals, Metals Park, OH (1988). (CONF-8610374–: ASM materials seminar on computer simulation in materials science, Lake Buena Vista, Florida, USA, 4-5 Oct 1986).

The technique of computer simulation of the molecular dynamics in metallic systems to calculate thermodynamic properties is discussed. The nature of a metal as determined by its electronic structure is used to determine the total adiabatic potential. The effective screened ion-ion interaction can then be used in a molecular dynamics simulation. The method for the construction of a molecular dynamics ensemble, its relation to the canonical ensemble, and the definition of thermodynamic functions from the Helmholtz free energy is given. The method for the analysis of the molecular dynamics results from quasiharmonic lattice dynamics, and the decomposition in terms of harmonic and anharmonic contributions is given for solids. For fluid-phase metals, procedures for calculating the thermodynamics and determining the constant of entropy are presented. The solid-fluid phase boundary as a function of pressure and temperature is determined using the results of molecular dynamics. Throughout, examples and results for metallic sodium are used. The treatment of the transition metal electronic d-states in terms of an effective pair-wise interaction is also discussed.

31234 Enhanced photochemistry on metal surfaces. Goncher, G.M. (Dept. of Chemistry and Materials and Molecular Research, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)); Parsons, C.A.; Harris, C.B. v.v of Laser chemical processing of semiconductor devices. Extended abstracts. Houle, F.A.; Deutsch, T.F.; Osgood, R.M. Jr. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

Due to the fast relaxation of molecular excited states in the vicinity of a metal or semiconductor surface, few observations of surface photochemistry have been reported. The following work concerns the surface-enhanced photo-reactions of a variety of physisorbed molecules on roughened Ag surfaces. In summary, photodecomposition leads to a graphitic surface carbon product which is monitored via surface-enhanced Raman scattering. In most cases an initial

two-photon molecular absorption step followed by further absorption and fragmentation is thought to occur. Enhancement of the incident fields occurs through roughness-mediated surface plasmon resonances. This mechanism provides the amplified electromagnetic surface fields responsible for the observed photodecomposition. The photodecomposition experiments are performed under ultra-high vacuum. Surface characterization of the roughened surfaces was done by Scanning Electron Microscopy (SEM), and electron-stimulated emission. The SEM revealed morphology on the order of 300-400 A. This size of roughness feature, when modelled as isolated spheres should exhibit the well-known Mie resonances for light of the correct wavelengths. For protrusions existing on a surface these Mie resonances can be thought of as a coupling of the light with the surface plasmon. Experimental verification of these resonances was provided by the electron-stimulated light emission results. These showed that a polished Ag surface emitted only the expected transition radiation at the frequency of the Ag bulk plasmon. Upon roughening, however, a broad range of lower frequencies extending well into the visible are seen from electron irradiation of the surface. Large enhancements are expected for those frequencies which are able to couple into the surface modes.

31235 Grain-boundary modeling. Wolf, D. (Materials Science Div., Argonne National Lab., Argonne, IL (US)). v.v of Computer simulation in materials science. Arsenault, R.J.; Beeler, J.R.; Esterling, D.M. American Society for Metals, Metals Park, OH (1988). (CONF-8610374–: ASM materials seminar on computer simulation in materials science, Lake Buena Vista, Florida, USA, 4-5 Oct 1986).

A rather comprehensive set of computer codes has been developed in recent years enabling one to investigate the physical properties of grain boundaries in metals and predominantly ionic ceramic materials. In this brief overview the modeling of grain boundaries in metals at absolute zero temperatures by means of lattice-statics (iterative energy minimization methods) is described. In contrast to experiments, in computer simulations it is rather easy to systematically vary the five macroscopic geometrical parameters describing a planar, bicrystalline grain boundary. In this manner, computer modeling can be used to extract rather fundamental insight into the physics of solid interfaces. By comparing the results of such computer experiments with experimental results whenever possible, the validity range of these simulation methods can be tested. As reviewed in this chapter, the combination of computer-simulation studies with related experiments is capable of providing insight which, from experiments alone, would be very difficult to obtain.

31236 The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel. Wilde, B.E. (Sandia National Labs., Albuquerque, NM (US)); Manohar, M.; Diegle, R.B.; Hayes, K. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

Hydrogen induced fracture of steel components often occurs with spectacular results, leading to total annihilation of the structure. Although the cause of these hydrogen embrittlement (HE) failures is the occlusion of hydrogen into the structure from (a) corrosion, (b) welding, and (c) steelmaking, the materials community has not been able to provide an answer over the last 80 years. Several operational guidelines have been used with some success, but if enough stress is present, a steel, containing occluded hydrogen, will fail by premature fracture. This paper describes a new approach that may control the HE problem: the use of surface modification to impede hydrogen ingress into the steel. There can be little argument with the premise "keep hydrogen out and failure by HE will not occur." The procedures investigated were amorphous Ni/P alloy deposition on AISI 1018 and 4130 steel substrates by plasma-enhanced chemical vapor deposition and electrodeposition.

31237 Effects of scratched surfaces on passivation, anodic dissolution and hydrogen evolution kinetics. Gopaliengar, R. (Corrosion Research Center, Univ. of Minnesota, Minneapolis, MN (US)); Oriani, R.A. v.v of Proceedings of the 1987 Electrochemical Society spring meeting: Extended abstracts. Volume 87-1. The Electrochemical Society, Pennington, NJ (1987). (CONF-870560–: 171. Electrochemical Society meeting, Philadelphia, Pennsylvania, USA, 10-15 May 1987).

The passivating film at the tip of a crack in a metallic body subjected to mechanical stress can be ruptured by emerging slip steps. There has been much speculation as to whether or not the surface bared by slip exhibits a larger rate of cathodic reduction of hydrogen ion than does than an annealed surface and/or a larger rate of active anodic dissolution. The reason for concern is the enhancement of either reaction can lead to stress corrosion cracking by hydrogen embrittlement, anodic dissolution or a combination of both mechanisms. Another very important characteristic that should be known is the repassivation kinetics. The present work attempts to obtain some understanding of the complex kinetics on freshly bared surfaces by observing kinetics on scratched surfaces and comparing them with kinetics on unscratched surfaces.

31238 Simulated response of multilayer x-ray reflectors to damaging fluxes. Gray, K. J. (Department of Physics and Astronomy, Brigham Young University, Provo, Utah 84602(US)); Peterson, B. G.; Knight, L. V.; Thorne, J. M. *Computers in Physics (USA)*, 3(4): 65-68 (Jul 1989).

A computer code ROMULS has been developed which computes the x-rayreflectivity versus angle versus time response of multilayer x-ray reflectorsexposed to damaging, monochromatic, x-ray fluxes for short pulse applications.The code employs exponential x-ray absorption, hydrodynamic and thermodynamicmodeling of structural and individual layer damage, and recursive calculation ofthe multilayer reflectivity. Comparison of simulations and experiments indicatesthat the code underestimates the useful life of multilayers by about a factor of2. Simulations require approximately 1 min of MicroVAX II CPU time permultilayer layer pair per nanosecond of simulated time.

31239 Lithium depletion in precipitate free zones (PFZ's) in Al-Li base alloys. Radmilovic, V. (Univ. of Belgrade, Dept. of Metallurgy, Belgrade, Karnegijeva (YU)); Fox, A.G.; Fisher, R.M.; Thomas, G. *Scripta Metallurgica (USA)*, 23(1): 75-79 (Jan 1989).

Since the effects of precipitate free zones (PFZ's) were first examined in high strength Al-Mg-Zn alloys much attention has been paid to PFZ's and their deleterious effects, especially with respect to the mechanical behavior, fracture and stress-corrosion cracking, in a wide range of conventional high strength Al-base alloys, as well as in the newer high strength Al-Li alloys for aerospace applications. In terms of complexities and mechanisms of precipitate nucleation and growth, including considerable non-uniformity due to heterogeneous nucleation, conventional Al base alloys are very similar to the Al-Li base alloys. The optimization of properties requires uniformity of precipitation with suitable volume fractions of appropriate precipitates. Heterogeneous nucleation may modify the desired morphology, but this mode can also be utilized to increase nucleation rates e.g., by mechanical deformation as in the complex theromechanical treatments (TMT) currently being pursued. An alternative technique for compositional analysis, although indirect, which can be utilized by high voltage microscopy (HVEM) is that of the so called critical voltage effect. It should be possible to detect lithium depletion in PFZ's in Al-Li alloys by this method, and such is the object of the present work.

31240 Deformation and failure mechanisms of niobium and tantalum during tensile testing in uranium at 1473 K. Huang, J.S. (Lawrence Livermore National Lab., Livermore, CA (US)); Gallegos, G.F.; Stratman, M.P.; Sedillo, E. *Scripta Metallurgica (USA)*, 23(1): 103-108 (Jan 1989).

It is well known that, when a higher-melting-point solid metal is exposed to the combination of a specific lower-melting-point liquid metal and stress, severe embrittlement can occur. This is known as liquid metal embrittlement (LME). Refractory metals with high melting points and good workability, such as the Group VB metals (V, Nb, and Ta) have been used to construct molds for casting other metals that have low melting points. One of these low-melting-point metals is U, which is used in nuclear power reactors as fuel. However, it was previously reported that severe degradation occurred when Ta was exposed to liquid U. The kinetics of the penetration of U into Ta under stress-free conditions were studied. It was found that, between 1433 K and 1623 K, despite the low solubility of U in

Ta, the Ta matrix recrystallized into elongated grains, and U penetrated between the grains. The penetrated U existed in front of the transformed grains as a separate layer and along grain boundaries. For conditions in which stresses exist, it is expected that the penetration of liquid uranium could be further accelerated and thus embrittle the Ta matrix. There is no detailed study about the LME mechanisms of Group VB metals in liquid U. The authors have initiated a research activity to study the mechanisms of embrittlement of Nb and Ta by liquid uranium. Their initial results, as reported in this paper, indicate a significant difference between Nb and Ta when exposed to liquid U and subjected to tensile stress.

31241 Mechanical properties of particulate composites based on a body-centered-cubic Mg-Li alloy containing boron. Whalen, R.T. (NASA-Ames Research Center, Moffett Field, CA (US)); Gonzalez-Doncel, G.; Robinson, S.L.; Sherby, O.D. *Scripta Metallurgica (USA),* 23(1): 137-140 (Jan 1989).

Previous studies showed that a high specific stiffness of 4.3 x 10/sup 6/m could be achieved in magnesium by the addition of 25 volume percent of boron particles. Poor tensile ductility properties were obtained, however, which were attributed to the large volume fraction of hard particles and to the low ductility of the hcp magnesium matrix. The purpose of the present investigation was to improve the ductility of Mg-B composites by substituting for magnesium a Mg-14wt%Li solid solution alloy. Such an alloy is known to exhibit high ductility because of its body-centered-cubic structure. Another advantage of adding lithium is that it decreases the density of magnesium, and therefore the specific stiffness can be expected to increase.

31242 The determination of impurities in plutonium metal by anion exchange and ICP/AES. Huff, E. A. (Analytical Chemistry Laboratory, Chemical Technology Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439(US)); Bowers, D. L. *Applied Spectroscopy (USA),* 43(2): 223-225 (Feb 1989). DOE Contract W-31-109-ENG-38.

The determination of trace-metal impurities in plutonium metal wasinvestigated with the use of anion exchange separation and analysis byinductively coupled plasma/atomic emission spectrometry. Data onrecoveries and independent measurements for some 30 elements showprecisions and accuracies in the 1–10% range, values that are asignificant improvement over those of traditional carrierdistillation techniques. Americium can be determined on the samesample aliquot, with figures of merit rivaling those of nuclear countingprocedures.

31243 A 4-electrode analogue for estimating electrochemical reactions with bare metal surfaces at the crack tip. Wei, R.P. (Lehigh Univ., Bethlehem, PA (US)); Alavi, A. *Scripta Metallurgica (USA),* 22(7): 969-974 (Jul 1988).

A 4-electrode in situ fracture technique has been developed as an analogue for estimating the kinetics of electrochemical reactions with bare metal surfaces at the crack tip under an externally applied potential. The considerations that led to this development are briefly summarized and the technique is described. The relevance and effectiveness of this technique are illustrated by a comparison of the charge transfer and corrosion fatigue crack growth data on high strength steel. The results suggest that the electrode potential at the crack tip does not deviate substantially from the free corrosion potential.

31244 Modulating the composition of a metal/oxide interface and using hydrogen as a probe. Mader, W. (Max-Planck-Institut fur Metallforschung, Institut fur Werkstoffwissenschaften, Stuttgart-1 (DE)); Kirchheim, R.; Huang, X.Y..; Eastman, J.A. *Scripta Metallurgica (USA),* 22(7): 1109-1114 (Jul 1988).

Strong irreversible traps for hydrogen atoms in internally oxidized Pd-3 at. % Al alloys are related to segregation at the Pd/Al/sub 2/O/sub 3/phase boundaries. From an estimation of the strength of the binding energy, simple thermodynamic considerations, and sample preparation in an oxygen excess environment concluded that unsaturated oxygen bonds are present at the phase boundary and that the trapping corresponds to the formation of O-H bonds. For the case of Al-excess, oxygen bonds should be all saturated and Al-bonds remain unsaturated where no strong trapping of hydrogen expected in agreement with experiment. The case of free oxygen bonds at the interface and the irreversible trapping of hydrogen could be regained by annealing in air. Thus, hydrogen provides evidence that the composition of a phase boundary can be modulated depending on the chemical potentials of the species forming the compound.

31245 Effect of chromium on room temperature ductility and fracture mode in Fe/sub 3/Al. McKamey, C.G. (Metals and Ceramics Div., Oak Ridge National Lab., Oak Ridge, TN (US)); Horton, J.A.; Liu, C.T. *Scripta Metallurgica (USA),* 22(10): 1679-1681 (Oct 1988).

The unique electrical, magnetic, and corrosion resistance properties of iron-aluminides with compositions near that of Fe/sub 3/Al have long stimulated the interest of material scientists. Combined with low cost of iron and aluminum, lower density compared with steels, and adequate strength at temperatures below 600^0C, iron aluminides are attractive candidates for structural applications in many industries. However, the lack of ductility at ambient temperatures and a sharp drop in strength above 600^0C have been major obstacles to their development as structural materials. The authors studies, conducted using a base alloy of Fe-28 at.% Al, have indicated that the room temperature ductility can be improved by a factor of at least two by additions of chromium of up to 6 at.%. It has been found that, although the room temperature strengths are decreased slightly, the elongation to fracture is increased from below 4% with no chromium to 8-10% for additions of 2-6 at.% chromium. Elongations of up to 13% were produced by varying the rolling schedule and/or a post-rolling heat treatment.

31246 The stress state close to a crack tip shielded by a dislocation array. Lii, M. (Dept. of Chemical Engineering and Materials Science, Univ. of Minnesota, Minneapolis, MN (US)); Gerberich, W.W. *Scripta Metallurgica (USA),* 22(11): 1779-1782 (Nov 1988).

The dislocation shielding effect in the fracture of many FCC and BCC crystals has been discussed. In general, under a Mode I loading condition, it is suggested that dislocation shielding can result from plastic deformation which then prevents the propagation of a crack. This means that due to the back stresses of shielding the stress singularity at the crack tip may be down to zero or become negligible. Furthermore, previous workers proposed a simplified super-dislocation model to simulate the plastic relaxation at a crack tip. This model has been shown to represent the plasticity near the crack tip similar to the Dugdale model. In this analysis, the interactions between the external applied stresses, the crack and the super-dislocation are based on generalized crystal mechanics. Therefore, it can be applied to anisotropic media as well as isotropic media. Though these models can estimate the crack tip displacement from the balance of shielding back stresses and the external applied loads, they still have not been utilized to predict the stress tensor of the whole field. The authors could find no stress computation presented based upon this approach. In addition, it was of interest to consider an array rather than a single super-dislocation. As a result, a modified model was used to evaluate the stress tensor associated with a crack which is shielded by a dislocation array.

31247 Structure determination of metastable cobalt films. Idzerda, Y. U. (Naval Research Laboratory, Washington, D.C. 20375(US)); Elam, W. T.; Jonker, B. T.; Prinz, G. A. *Physical Review Letters (USA),* 62(21): 2480-2483 (22 May 1989).

The bulk atomic structure of cobalt films deposited on GaAs has been unequivocally determined to be the body-centered-cubic metastable phase. A comparison of the conversion-electron x-ray-absorption fine structure of Co films deposited on GaAs(110) with similar measurements for the stable phases of hcp Co, fcc Cu, and bcc Fe establishes the Co bcc phase with a lattice constant of 2.82 ± 0.01 A. Furthermore, this first application of the technique to single-crystal epitaxial films shows it to be a most powerful procedure for establishing their crystal structure.

31248 Microscopic real-space approach to the theory of metallic glasses. Zhao, G. (Department of Physics, University of MissouriKansas City, Kansas City, Missouri 64110(US)); Ching, W. Y. *Physical Review Letters (USA),* 62(21): 2511-2514 (22 May 1989).

The electronic and transport properties of three metallic glass systems, *a*-$Cu_{60}Zn_{40}$, *a*-$Mg_{75}Zn_{25}$, and *a*-Ni, are studied by means

of realistic microscopic real-space calculations. At low temperature, the transport properties are contrilled by the magnitude and the shape of the conductivity function σ_E near the Fermi energy. It is shown that for a stable metallic glass the Fermi energy is quite close to a local minimum in σ_E and this causes the negative temperature coefficient of resistivity which is purely due to the elastic scattering of the conduction electrons from the disordered atoms.

31249 Spin echo NMR of cobalt zeolite catalysts: control of particle size and structure. Zhang, Z. (Univ. of Connecticut, Storrs (USA)); Suib, S.L.; Zhang, Y.D.; Hines, W.A.; Budnick, J.I. *Journal of the American Chemical Society (USA),* 110(16): 5569-5571 (3 Aug 1988).

The results of studies using spin echo NMR (SENMR) carried out at low radio frequency power to investigate ^{59}Co ferromagnetic particles with zero external magnetic field are reported. It is shown herein that the desired size and structure of cobalt particles in zeolites can be obtained and that coadsorption of organometallics in zeolite pores activated in a microwave discharge can control the structure of the resultant metal particles. A new alloy of iron and cobalt has been prepared and characterized by SENMR. 15 references, 1 figure, 1 table.

31250 Energetics of transition-metal alloy formation: Ti, Zr, and Hf alloyed with the heavier 4*d* and 5*d* elements. Watson, R. E. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973(US)); Weinert, M.; Davenport, J. W.; Fernando, G. W. *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 10761-10769 (15 May 1989). DOE Contract AC02-76CH00016.

Total-energy calculations yielding heats of formation for ordered compounds of Ti, Zr, and Hf alloyed with Tc, Re, Ru, Os, Rh, Ir, Pd, and Pt are presented. There exist both experimentally based phase diagrams and a substantial number of experimental heats of formation for these systems, and the present results are in accord with these; e.g., the co-occurrence of compounds at differing compositions is correctly predicted. The heats, as a function of the fractional alloy composition x, generally differ markedly from the $x(1-x)$ dependence so often envoked. An explanation of the heat behavior for the Ti-, Zr-, and Hf-depleted alloys is found in their densities of states and is associated with the *d* bands of the other alloy constituent being decoupled from the Fermi level.

31251 Mössbauer spectrometry study of the hyperfine fields and electronic structure of Fe-Co alloys. Hamdeh, H. H. (Division of Engineering and Applied Science 138-78, California Institute of Technology, Pasadena, California 91125(US)); Fultz, B.; Pearson, D. H. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11233-11240 (1 Jun 1989).

We obtained ^{57}Fe hyperfine-field parameters from Mössbauer spectra of Fe-Co alloys at 77 and 295 K. We also obtained the numbers of 3*d* electrons at Fe atoms by electron-energy-loss spectrometry (EELS). Together with bulk-magnetization data, we deduce how the occupancies of the $3d\uparrow$ and $3d\downarrow$ states at Fe atoms change with Co concentration. Changes in the total numbers of 3*d* electrons at Fe atoms were found to be small, with the Mössbauer data indicating a maximum of about 0.2 electrons at 30 at. % Co, and the EELS data indicating a change of similar magnitude but of opposite sign. From both our isomer-shift and hyperfine-magnetic-field (HMF) data, we deduce a slight reduction in the occupancy of 4*s* states with Co concentration of $dn_{4s}/dc=-0.02$ electrons, which is principally due to a loss of $4s\downarrow$ electrons. The model employed for the calculation of HMF distributions in terms of conduction- and core-electron polarizations worked well for disordered Fe-Co alloys, and was used to analyze the changes in HMF after the disorder→order transformation. It showed that these HMF changes upon ordering are primarily due to changes in conduction-electron polarization.

31252 Muon spin rotation in the magnetic and superconducting ground states of (U,Th)Be$_{13}$ and (U,Th)Pt$_3$. Heffner, R. H. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Cooke, D. W.; Giorgi, A. L.; Hutson, R. L.; Schillaci, M. E.; Rempp, H. D.; Smith, J. L.; Willis, J. O.; MacLaughlin, D. E.; Boekema, C.; and others. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11345-11357 (1 Jun 1989).

Microscopic aspects of magnetism and superconductivity have been studied in the heavy-fermion superconducting alloy systems (U,Th)Be$_{13}$ and (U,Th)Pt$_3$ using the technique of positive-muon (μ^+) spin rotation and relaxation (μSR). In $U_{1-x}Th_xBe_{13}$, x=0.033, a striking increase of zero-field Kubo-Toyabe relaxation rate σ_{KT} is observed below the temperature $T_{c2}\cong 0.4$ K at which a second phase transition occurs in the superconducting state. This jump is firm evidence for the onset of weak static magnetism below T_{c2}. The observed increase of ~1.5 Oe in the μ^+ local field corresponds to an effective moment of 10^{-3}–10^{-2} μ_B/U atom.

31253 Spin dynamics of Gd at high temperatures. Cable, J. W. (Oak Ridge National Laboratory, Solid State Division, P.O. Box 2008, Oak Ridge, Tennessee 37831(US)); Nicklow, R. M. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11732-11741 (1 Jun 1989). DOE Contract AC05-84OR21400.

The magnetic excitation spectra of Gd were measured by neutron inelastic scattering over the entire Brillouin zone in the ⟨110⟩ direction at temperatures from 250 to 850 K (T_c=293 K). The data were fitted to a damped-harmonic-oscillator form for the spectral weight function and were placed on an absolute cross-section basis. Wave-vector-dependent susceptibilities were obtained by integration over energy. They clearly show the presence of static spin correlations even at T=850 K. At $T\geq T_c$ we observe a crossover from spin-diffusive motion at small q to spin-wave behavior at large q. The wave vector q_c at which this crossover occurs is determined by the ratio of the damping parameter to the second moment, $\langle\omega^2\rangle$, of the frequency distribution. Surprisingly, $\langle\omega^2\rangle$ remains independent of temperature above T_c, and the temperature dependence of q_c is therefore determined by a gradual change in the damping. This results in a very weak q_c-versus-T dependence, which is not consistent with a magnetic short-range-order interpretation for the existence of spin waves above T_c.

31254 Magnetic behavior in Mg-stabilized bcc β-Gd and β-Dy. Herchenroeder, J. W. (Ames Laboratory and Department of Materials Science and Engineering, Iowa State University, Ames, Iowa 50011(US)); Gschneidner, K. A., Jr. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11850-11861 (1 Jun 1989). DOE Contract W-7405-ENG-82.

bcc β-Gd and β-Dy, stabilized by Mg additions, exhibit spin-glass-like behavior. Both systems show field-cooling effects in the magnetic susceptibility which is indicative of spin freezing reactions. The β-Gd alloys order ferromagnetically (<80 K) first on cooling before undergoing a Gabay-Toulouse-type reentrant spin-glass transition (<50 K) into a mixed ferromagnetic plus spin-glass phase. Low-field ac susceptibility measurements show both the Curie and spin freezing transitions. Low-temperature heat capacity (down to 1.5 K) shows evidence of both ferromagnetic and spin-glass excitations. A magnetic phase diagram predicts a pure spin-glass phase for Gd concentrations up to 66 at. % Gd. The β-Dy alloys exhibit a cusp in the ac susceptibility characteristic of spin-glass behavior. Field-cooled magnetic-susceptibility measurements suggest a close competition between antiferromagnetism and spin-glass behavior. The occurrence of the maximum in the magnetic susceptibility at 1.4 T is evidence that some atoms may order antiferromagnetically. A large linear heat-capacity term which is probably due to both the electronic specific heat γ and a spin-glass contribution plus the presence of large T^2 and T^5 terms support the mixed-state hypothesis. The metastable bcc Gd-Mg and Dy-Mg alloys are unique in that they have the highest concentration of magnetic atoms in a *crystalline, metallic* spin glass (>70 at. % Gd or Dy).

31255 Low-field Hall effect near the percolation threshold. Marianer, S. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Bergman, D. J. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11900-11906 (1 Jun 1989).

We use a random-resistor-network model to study the critical behavior of the low-field Hall constant in a three-dimensional (3D) metal-insulator composite near the percolation threshold. The transfer-matrix method, which was originally introduced for calculating conductivity, is generalized to be applicable to the calculation of the Hall constant and the magnetoresistance as well. We then use this generalized method to perform a renormalization-group calculation for a cubic random resistor network and two simulations of random resistor networks at the percolation threshold: one of cubes and the other of long (3D) strips. Fitting an expression

$R_H \propto (p-p_c)^{-g}$ to the effective Hall constant R_H of the network, we find a divergent Hall constant both from the renormalization-group calculation (g=0.625) and from the simulation of cubes (g=0.25), while the long-strips simulation yields one that is concentration independent, i.e., g=0.

31256 Extended x-ray-absorption fine-structure study of copper under high pressure. Freund, J. (Department of Physics (FM-15), University of Washington, Seattle, Washington 98195(US)); Ingalls, R.; Crozier, E. D. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12537-12547 (15 Jun 1989).

We examine copper as a pressure calibrant for extended x-rayabsorptionfine-structure (EXAFS) measurements of solids under pressures ranging from 0 to10 GPa. Great care must be exercised both in the theoretical formulation ofEXAFS and in the data analysis in order to achieve the high precision requiredto make copper a useful pressure marker. From the first-shell k-spacedata, phase and amplitude information is extracted both with the ratio methodand from fitting parameters with the help of theoretically calculatedcentral-atom phase shifts [B.-K. Teo and P. A. Lee, J. Am. Chem. Soc.101, 2815 (1979)] and curved-wave backscattering phase shiftsand amplitudes [A. G. McKale *et al.*, J. Am. Chem. Soc.110, 3763 (1988)]. Both techniques yield practically identicalresults confirming the reliability of the phase and amplitude tabulations. Butboth techniques suffer from the ambiguity that the results depend on how manyEXAFS parameters are kept variable. It is shown that, for copper, onlynearest-neighbor distances and second cumulants (EXAFS Debye-Waller factors)have to be taken into account. Then pressures can be determined with anaccuracy of about 0.5 GPa. We also present two models for the pressuredependence of the second cumulant: (1) a correlated Debye model along withsimple parametrizations of the isothermal equation of state and theGrüneisen parameter, and (2) a model for the calculation of the moments ofthe nearest-neighbor distance distribution from an expansion to third order ofthe potential energy. Both models confirm our data analysis.

31257 Alloy models with the embedded-atom method. Johnson, R. A. (Materials Science Department, University of Virginia, Charlottesville, Virginia 22901(US)). *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12554-12559 (15 Jun 1989).

A simple analytic nearest-neighbor embedded-atom-method model developed formonatomic fcc metals has been extended to study alloying. The two-bodypotential between different species of atoms is taken as a function of thetwo-body potentials for the pure metals with a unique form which yields alloymodels with the same invariance to electron density transformations asmonatomic models. With several approximations, all model parameters are givenby experimentally measured physical quantities. The dilute-limit heats ofsolution for all binary alloys of Cu, Ag, Au, Ni, Pd, and Pt have beencalculated, with generally good agreement with available experimental valuesexcept for Pd, for which the calculated values are uniformly too high. Thequalitative relationships between the physical parameters of the solute andsolvent and the heat of solution have been determined.

31258 Adsorbed layer and multilayer materials: The energetics and bonding of Pd and Ag on Nb(001) and Nb(110). Weinert, M. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973(US)); Watson, R. E.; Davenport, J. W.; Fernando, G. W. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12585-12597 (15 Jun 1989). DOE Contract AC02-76CH00016.

The energetics of transition-metal–transition-metal adlayer adhesion andthe heats of formation for competing ordered compounds have been investigatedusing total-energy calculations in order to disentangle the factors controllingadlayer behavior. The calculated energies are used to estimate interfaceenergies, distortion energies associated with requiring an adlayer to becommensurate with its substrate, the surface energies of the bare metalsurfaces of Nb(110), Nb(001), Ag(110), Ag(001), Pd(110), and Pd(001), and thesurface energies associated with the presence of an adlayer. The resultsprovide a picture consistent with the experimentally known adlayer behavior forPd-Nb(001), Pd-Nb(110), and Ag-Nb(110) and have implications for the growth ofartificial multilayer (superlattice) materials. While Pd adsorption on Nb canalready be understood in terms of bulk interface energetics, for Ag on Nb thesurface contributions are essential. Densities of states obtained for bulkmultilayers display markedly different bonding at the Pd-Nb and Ag-Nbinterfaces, although all show a pronounced interface state ~1.5 eVabove the Fermi level. The intensity of this peak, which also exists at thesurface, reflects the strength of bonding at the interface.

31259 Comparative study of angle-resolved valence-band photoemission from half-monolayer structures of C, N, and O on Ni(100). Kilcoyne, A. L. D. (Department of Physics, University of Warwick, Coventry CV47AL, United Kingdom(US)); Woodruff, D. P.; Rowe, J. E.; Gaylord, R. H. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12604-12611 (15 Jun 1989).

Angle-resolved synchrotron-radiation photoemission has been used to map theadsorbate-induced surface valence bands of the simple chemisorbedNi(100)$c(2\times2)$-O structure and the reconstructedNi(100)(2×2)-N structure; the results are compared with a similarprevious study of the reconstructed Ni(100)(2×2)-C structure. Theoxygen adsorption system shows three 2p-derived bands broadly inagreement with early calculations by Liebsch, although the splitting of thep_z and p_x,p_y bands at the $\bar{\Gamma}$ point is revealed convincingly only in data taken in the second surfaceBrillouin zone and folded back to the zone center; at normal emission on theNi(100) substrate, emission due to a Ni satellite peak confuses theinterpretation. The two adsorbate-induced reconstructed surfaces show somesystematic differences, both in the presence of additional structure close tothe Fermi level and in the apparent absence of a 2p-derived band whichcan be assigned to p_z character. Symmetry of the glide planerestricts the observed adsorbate band dispersion to be close to that of theunreconstructed Ni(100)-O structure, $c(2\times2)$.

31260 Relativistic effects in the electronic structure of Cu{001}. Wu, S. C. (Physics Department, Peking University, Beijing, People's Republic of China(CN)); Sokolov, J.; Lok, C. K. C.; Quinn, J.; Li, Y. S.; Tian, D.; Jona, F. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12891-12894 (15 Jun 1989).

Angle-resolved photoemission from Cu{001} with pure s-polarized lightgives evidence for direct electron transitions from the $\Delta_2$band, which are forbidden by the nonrelativistic dipole selection rules. Theeffect is explained by the mixing of additional orbitals into therelativistic-band basis set. Critical points for relativistic bands aremeasured as $\Gamma_{8+}=-2.85\pm0.10$ eV,$\Gamma_{7+}=-3.40\pm0.10$ eV,$\Gamma_{8+}=-3.70\pm0.10$ eV, and are ingood agreement with the results of the self-consistentrelativistic-band-structure calculations of Eckardt, Fritsche, and Noffke.These observations confirm earlier reports by other workers which indicatedthat relativistic effects can play an important role in the electronicstructure of first-row transition elements.

31261 Interpretation of the optical properties of Nb. Kim, B. (Department of Physics and Ames Laboratory, Iowa State University, Ames, Iowa 50011(US)); Harmon, B. N.; Lynch, D. W. *Physical Review [Section] B: Condensed Matter (USA),* 39(18): 13146-13148 (15 Jun 1989). DOE Contract W-7405-ENG-82.

The interband optical conductivity of Nb was calculated from aself-consistent relativistic band structure. For the optical conductivity, themajor relativistic effect is the lowering of the s-like bands relative tothe d-like bands, not spin-orbit splitting. k-space searchesidentified the regions of the Brillouin zone contributing to the principalstructures of the optical conductivity. The regions were found to be largevolumes of the zone that did not include symmetry points or lines. Along withprevious results for Mo, the good agreement between theory and experimentsuggests that the effects of the omitted self-energy are small for these twobcc metals.

31262 Surface states on NiAl(110). Lui, S. (Laboratory for Research on the Structure of Matter, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6202(US)); Kang, M. H.; Mele, E. J.; Plummer, E. W.; Zehner, D. M. *Physical Review [Section] B: Condensed Matter (USA),* 39(18): 13149-13159 (15 Jun 1989). DOE Contract AC05-84OR21400.

Surface states on NiAl(110) have been investigated experimentally usingangle-resolved photoemission and theoretically with a self-consistentpseudopotential scheme within the local-density approximation (LDA). Boththeory and experiment show that the termination of bulk NiAl at the (110)surface creates surface states in

the gap regions of the projection of the bulkbands and strong *d* resonance states around the gap edges. In general, theenergy position, symmetry, and dispersion of the surface-state bands observedexperimentally are reproduced by the theoretical calculation. The first momentof the surface density of states (DOS) is shifted towards the Fermi level by≈0.5 eV, suggesting that the surface Ni and Al atoms in the alloyhave recovered some of their individual bonding behavior. However, the totalsurface DOS at the Fermi level shows negligible change from that of the bulk,thus indicating the absence of a magnetic surface layer.

31263 Discrete and continuous disorder in superlattices. Locquet, J. (Laboratorium voor Vaste Stof-Fysika en Magnetisme, Katholieke Universiteit Leuven, B-3030 Leuven, Belgium(BE)); Neerinck, D.; Stockman, L.; Bruynseraede, Y.; Schuller, I. K. *Physical Review [Section] B: Condensed Matter (USA),* 39(18): 13338-13342 (15 Jun 1989).

We have derived a general diffraction relation for crystalline-crystallinesuperlattices including discrete fluctuations on the number of atoms in a layerand continuous fluctuations on the interface distance, both of a Gaussian type.We show that discrete fluctuations can markedly increase the linewidth ofhigh-angle (large-*q*) diffraction peaks in lattice-mismatched systems.Moreover, we show that this line broadening increases strongly with increasinglattice mismatch and prove that these fluctuations on lattice-matched systemssuch as semiconductor superlattices are difficult to detect by high-angledIffraction techniques. These results have serious implications for theclassical interpretation of x-ray diffraction from superlattices regarding thedetermination of elastic strains and the reconstruction of compositionprofiles.

31264 Hall mobility of positive carriers in the semimetallic compound LiGa. Kuriyama, K. (College of Engineering and Research Center of Ion Beam Technology, Hosei University, Koganei, Tokyo 184, Japan(JP)); Yahagi, M.; Susman, S.; Volin, K. J.; Brun, T. O. *Physical Review [Section] B: Condensed Matter (USA),* 39(18): 13508-13509 (15 Jun 1989).

The temperature-dependent Hall coefficient and Hall mobility above 90 K ofLiGa are presented for the Li-deficient phase. These results indicate that theholes are the majority carriers in LiGa and their mobility is dominated by thelattice-phonon scattering. The difference in the hole mobility between LiGa andLiAl suggests that the band overlap of the hole and electron pockets is greaterin LiGa than in LiAl. The "positive" Hall coefficient is also associated withthe lowering of the Fermi energy in the "real" defect phase LiGa resultingfrom the constitutional lithium vacancies.

31265 Fermi-level tuning in $Y_{1-x}U_xPd_3$. Kang, J. (Department of Physics, University of Michigan, Ann Arbor, Michigan 48109-1120(US)); Allen, J. W.; Maple, M. B.; Torikachvili, M. S. *Physical Review [Section] B: Condensed Matter (USA),* 39(18): 13529-13532 (15 Jun 1989).

The 5*f*-electron photoemission peak 1 eV below the Fermi energyE_F in UPd_3 is generally assigned as $a5f^2 \rightarrow 5f^1$ transition, consistent with other evidence ofa stable U^{4+} valence state. We report resonant photoemissionspectra for the system $Y_{1-x}U_xPd_3$which show that the peak narrows and shifts to the Fermi level as *x*decreases from 1. We hypothesize that the shift arises from a decrease in theFermi energy as Y^{3+} replaces U^{4+}, and thereforeexpect interesting changes in transport properties as E_F is tunedin this way.

3602 Ceramics, Cermets, and Refractories

Refer also to citation(s) 30604, 30650, 30804, 30865, 30969, 31048, 31051, 31052, 31159, 31186, 31228, 31235, 31314, 31368, 31393, 31643, 32904

31266 (AD-A-204556/5/XAB) **Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988.** Geballe, T.H. Stanford Univ., CA (USA). W.W. Hansen Labs. of Physics. 31 Oct 1988. 7p. Available from NTIS, PC A02/MF A01.

Four methods for growing thin films of high Tc superconductors have been developed and properties of the films have been investigated. A new superconducting structure of composition $Y_2Ba_4Cu_8O_20$- has been discovered. In a number of ways it has properties which are better than those of the $YBa_2Cu_3O_7$ structures. It is less anisotrophic in the CuO_2 (conducting planes) and therefore has less (or no) twinning. It retains oxygen under vacuum conditions and thus may be superior for making planar Josephson junctions.

31267 (AD-A-204575/5/XAB) **Dielectric measurements of selected ceramic materials at 245 ghz.** Dutta, J.M.; Jones, C.R. North Carolina Central Univ., Durham, NC (USA). Dept. of Physics. 1 Nov 1988. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Applied Physics, Vol. 64, No. 9, 4674-4677(1 Nov 1988).

A double-beam interferometer that incorporates quasi-optical components developed in this laboratory has been used to measure near millimeter-wave dielectric properties of a variety of ceramic materials. Results obtained on samples of various standard and advanced ceramics including alumina, silicon nitride, beryllia, and boron nitride are reported here. Results are compared with the data obtained by other researchers on similar samples.

31268 (CEA-CONF-9672) **Electronic structure and chemical bond of high Tc superconductors.** Gupta, R.P.; Gupta, M. Paris-11 Univ., 91 - Orsay. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie. 1988. 6p. (In French). (CONF-8809329--: Meeting on high temperature ceramic superconductors, Caen, France, 13-14 Sep 1988). Order Number DE89760613/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Results of the band structure calculations for the compound Bi/sub 2/Sr/sub 2/CaCu/sub 2/O/sub 8/are discussed and compared to those obtained for YBa/sub 2/Cu/sub 3/O/sub 7/. An analysis of the contribution of the densities of states at the different atomic sites shows that the states at the Fermi energy. E/sub F/, have a strong bidimensional character due to the CuO/sub 2/planes. Moreover, for the bismuth compound, the contribution of the Bi-O planes at E/sub F/is substantial. The elements Y and Ba in YBa/sub 2/Cu/sub 3/O/sub 7/, Ca and Sr in Bi/sub 2/Sr/sub 2/CaCu/sub 2/O/sub 8/act essentially as electron donors, the corresponding densities of states at E/sub F/are very small. An analysis of the electronic charge at the different atomic sites is presented. The respective roles of the CuO/sub 2/planes. Cu-O chains and Bi-O planes on the electronic properties at the Fermi level are discussed.

31269 (CONF-890306--4) **Erosion of Al and Al/SiC.** Wu, W.; Goretta, K.C.; Rohatgi, P.K.; Mostovoy, S.; Routbort, J.L. Argonne National Lab., IL (USA). Feb 1989. 12p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Industry-university advanced materials conference; Denver, Colorado, USA; 6-9 Mar 1989. Order Number DE89013623/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Aluminum-matrix composites are being developed for a variety of applications. In some of the applications, the composites may be subjected to erosion by solid particles. Previous studies of erosion of metal-matrix composites have shown that erosion rates are generally higher for the composites than for the unreinforced matrix. Increased erosion has been ascribed to the low ductility inherent in the composite materials. The effect of reduced ductility is especially strong for whisker-reinforced composites. This work was undertaken to investigate systematically solid-particle erosion of a common composite: cast 2014 Al containing particulate SiC. To further elucidate the mechanisms for erosion and the materials parameters affecting erosion rate, the alloys were examined in the as-received and heat-treated conditions. 11 refs., 4 figs.

31270 (CONF-890426--11) **Composition of superconducting $La_2CuO_{4+\delta}$: A superconductor doped by excess oxygen defects.** Dabrowski, B.; Hinks, D.G.; Jorgensen, J.D.; Richards, D.R. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Spring meeting of the Materials Research Society; San Diego, California, USA; 24-28 Apr 1989. Order Number DE89013299/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have studied mixed-phase samples of bulk La_zCuO_4 using neutron powder diffraction, thermogravimetric analysis and resistivity measurements. Samples fired at 950°C and slowly cooled form in

the K_2NiF_4 structure with CuO impurities for $z<2$ and La_2O_3 impurities for $z>2$. Neither La-vacancies nor stacking defects were found. The bulk resistivity of the samples show semiconducting behavior which is shorted at 38K by small amounts of superconducting material. The superconductivity is due to the presence of an oxygen-rich phase with stoichiometry $La_2CuO_{4.08}$. The occurrence of superconductivity in pure $La_2CuO_{4.08}$ with the same T_c as observed in the doped $La_{1.85}Sr_{0.15}CuO_4$ indicates that the excess oxygen provides the same level of doping as metal-ion substitution. 19 refs., 8 figs., 1 tab.

31271 (CONF-890426–12) **Study of nanophase TiO_2 grain boundaries by Raman spectroscopy.** Melendres, C.A.; Narayanasamy, A.; Maroni, V.A.; Siegel, R.W. Argonne National Lab., IL (USA). 1989. 6p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Spring meeting of the Materials Research Society; San Diego, California, USA; 24-28 Apr 1989. Order Number DE89012416/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Raman spectra have been recorded for as-consolidated nanophase TiO_2 samples with differing grain sizes and on samples annealed in air at a variety of temperatures up to 1273 K. The nanophase samples with the smallest grain size, about 12 nm average diameter, could have 15-30% of their atoms in grain boundaries; nevertheless, the strong Raman-active lines representative of the rutile structure were found to dominate all of the observed spectra, independent of grain size and annealing treatment. These lines were quite broad in the as-consolidated nanophase samples, equally in 12 nm and 100 nm grain-size compacts, but sharpened considerably upon annealing at elevated temperatures. The Raman data give no indication of grain-boundary structures in nanophase TiO_2 that are significantly different from those in conventional polycrystals. However, defect structures within the grains, which anneal out at elevated temperatures, are evidenced by changes in the Raman spectra. 15 refs., 2 figs.

31272 (CONF-8810290–2) **Development of magnetic resonance imaging technology for imaging binder distribution in ceramics.** Ellingson, W.A.; Wong, P.S.; Ackerman, J.L.; Yeh, H.C.; Pollinger, J.P. Argonne National Lab., IL (USA). Dec 1988. 15p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 26. automotive technology development contractors' coordination meeting; Dearborn, Michigan, USA; 24-27 Oct 1988. Order Number DE89013185/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Nuclear Magnetic Resonance (NMR) Technology is being developed as a method to characterize the distribution of organic binder/plasticizers in injection molded ceramics. Garrett Ceramic Component Divisions GN-10 Si_3N_4 in the material being studied. Binder loadings studied varied from 2-20 wt%. NMR spectroscopy data showed that NMR signals correlate to binder content. However, imaging data show that there is a peak value at 15.5 wt%. NMR relaxation phenomenon, e.g., T_2, does not vary with magnetic field strength, but does vary with temperature. For the present text setup, i.e., a 2T system with 3G/cm gradient, there is a limit of about 1-mm in spatial resolution. Higher gradients and changes in data acquisition techniques will significantly improve this limit. 18 refs., 11 figs., 1 tab.

31273 (CONF-8905105–2) **Numerical computation of bifurcation phenomena and pattern formation in combustion.** Bayliss, A.; Matkowsky, B.J.; Minkoff, M. Argonne National Lab., IL (USA). 1989. 20p. Sponsored by DOE/ER;OGA. DOE Contract W-31109-ENG-38;FG02-87ER25027. From 3. international conference on numerical combustion; Antibes, France; 23-26 May 1989. Order Number DE89013628/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

We develop and employ a new numerical method to study problems in both gaseous and solid fuel (condensed phase) combustion. The numerical method is an extension of the adaptive pseudo-spectral method previously introduced, in that two dimensional, non-product coordinate transformations are introduced so as to efficiently compute fronts which have a strong transverse variation. 15 refs., 6 figs.

31274 (CONF-8905118–8) **Electrochemical reactions in submerged arc welding with SiO_2-CaO-CaF_2 fluxes with high and low silica contents.** Indacochea, J.E.; Blander, M.; Polar, A. Argonne National Lab., IL (USA). 1989. 5p. Sponsored by Department of Defense. DOE Contract W-31109-ENG-38. From 2. international conference on trends in welding research; Gatlinburg, Tennessee, USA; 15-19 May 1989. Order Number DE89012421/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We examine the role of electrochemical reactions in submerged arc welding with different flux compositions based on high and low silica levels (40 w/o and 20 w/o, respectively) in the SiO_2-CaO-CaF_2 system. The welds were bead-on-plate, using d.c. reverse and straight polarities. Weld samples were removed for oxygen analysis and a number of electrode tips were collected for every weld sample by interrupting the arc after a fixed time into the weld operation; oxygen levels in these tips were determined. Optical microscopy was also performed on electrode tips to observe the inclusion population. The oxygen levels in the weld metal and electrode tip do not change significantly as the polarity is changed with the high silica fluxes. For the low silica fluxes, on the other hand, there are differences in the oxygen levels in the wire tips and weld metals as the polarity is changed. These results are consistent with an electrochemical mechanism and with preferential mechanical entrainment of flux in straight polarity. 10 refs., 4 figs., 2 tabs.

31275 (CONF-8905118–9) **Electrochemical transport of manganese between the flux and the weld metal in submerged arc welding.** Indacochea, J.E.; Blander, M.; Polar, A. Argonne National Lab., IL (USA). 1989. 6p. Sponsored by Department of Defense. DOE Contract W-31109-ENG-38. From 2. international conference on trends in welding research; Gatlinburg, Tennessee, USA; 15-19 May 1989. Order Number DE89012419/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Submerged arc welds were made using a SiO_2-CaO-CaF_2MnO flux containing 20 w/o MnO, 15 w/o CaF_2, and SiO_2 to CaO ratios that varied from 5.5 to 1.17; the slags formed from this flux system show good detachability and the welds produced have good bead morphology. The effect of dilution was eliminated by drawing the filler metal from the same material as the base plate. The welding parameters were the same for all welds and two polarities were used. The stability of the arc was also monitored and found to be stable, but more so for the reverse polarity welds. Chemical analyses were performed on flux, slag, and weld samples. The manganese content in the weld metal increases for all the fluxes, with the increases being larger the smaller the silica to calcium oxide ratio. This behavior can be explained by thermodynamically driven kinetic factors since, in this composition range, the activity of the manganese oxide increases with a decrease in the SiO_2/CaO ratio. When the SiO_2/CaO ratio is smaller than about 2.25, the manganese content in the welds made with reverse polarity is higher than those made with straight polarity. This difference in the manganese level is explained in terms of an electrochemical mechanism. 13 refs., 5 figs., 2 tabs.

31276 (DOE/ER/13183–3) **Experimental and kinetic modeling of acid/base and redox reaction over oxide catalysts: Annual report.** Dumesic, J.A. Wisconsin Univ., Madison, WI (USA). Dept. of Chemical Engineering. [1989]. 5p. Sponsored by DOE Energy Research. DOE Contract FG02-84ER13183. Order Number DE89013030/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During the past year our research efforts have focused on four main areas. In particular, we have been (1) using microcalorimetry to test our ideas about formulating a thermodynamic scale of acidity for solid oxides, (2) using solid state NMR to characterize support alumina catalysts, (3) building a special Mössbauer spectrometer to obtain ^{121}Sb spectra from solid super-acid materials, and (4) studying the reactions of nitrogen oxides and ammonia on vanadia/titania catalysts. We have made considerable progress in each of these areas, and this will be outlined in this report.

31277 (DOE/ER/45063–4) **Characterization of pore evolution in ceramics during creep failure and densification.** Southwest Research Inst., San Antonio, TX (USA). [1989]. 39p. Sponsored by DOE Energy Research. DOE Contract FG05-84ER45063. Order

Number DE89013599/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The processes involved in pore formation/removal can control the failure of ceramics at both high and low temperatures. Failure during creep at elevated temperatures, under all states of stress, is very sensitive to average porosity; such failure involves the nucleation, growth, and eventual coalescence of multiple pores. On the other hand, the failure of ceramics at lower temperatures is a weakest link process, with the number, distribution, size(s), and shapes of inherent pores within a ceramic body frequently constituting its principal weak links. Thus, a thorough understanding of the mechanisms of pore formation/removal is required such that pore formation can be minimized during creep and the opposite process, pore removal, can be maximized during densification. A three-year research program designed to substantially extend the previous work on pore revolution during both creep and densification is proposed herein. 67 refs., 10 figs., 3 tabs.

31278 (DOE/ER/45359–1) **The study of structure-processing-property relations in copper oxide-based high T_c superconductors: Progress report, July 1, 1988–March 1, 1989.** Kingon, A.I.; Koch, C.C.; Haase, D.G. North Carolina State Univ., Raleigh, NC (USA). 27 Feb 1989. 2p. Sponsored by DOE Energy Research. DOE Contract FG05-88ER45359. Order Number DE89012764/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report is a brief summary of research from July 1, 1988 to March 1, 1989. Microstructure-property relations have been examined in a series of polycrystalline ceramic $YBa_2Cu_3O_{7-\sigma}$ samples. (JDF)

31279 (DOE/ET/25108–T1) **Studies of synthesis, crystallography and sintering of β-aluminas: Final report, April 15, 1976–April 15, 1977.** Morgan, P.E.D. Franklin Inst. Research Labs., Philadelphia, PA (USA). May 1977. 38p. Sponsored by DOE Energy Research. DOE Contract AC02-76ET25108. (COO–2942-1). Order Number DE89012230/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The chemical effects of additives upon the crystallization of different forms of β and β'' alumina have been studied. Additives include Mg, Li, F, (OH) and N. The effects of sintering atmospheres upon both crystallization and sintering of precursor gel-like materials has been observed. We endorse the wisdom of using the 1:1/4:5, Na:Li:Al atom ratio β'' system which alone sintered satisfactorily below 1600°C to give almost single phase β'' material with high ionic conductivity. While fluoride is effective in generating pure β, sintering and conductivity are poor. 39 refs.

31280 (INIS-BR–1507) **Dielectric and piezoelectric properties of PZT sintered in low temperatures.** Menegazzo, B.A.; Haik, C.C.; Garcia, D.; Gelfuso, M.V.; Eiras, J.A. Associacao Brasileira de Ceramica, Sao Paulo, SP (Brazil). 1988. 14p. (In Portuguese). (CONF-8804217–: 32. Brazilian congress on ceramics, Natal, Brazil, 24-27 Apr 1988). Order Number DE89613397/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

PZT ceramics, in the boundary region of morphotopic phase (Zr/Ti=53/47), were doped with vanadium (V/sub 2/O/sub 5/) and sintered at 900 C and 1000 C during different time intervals. The Curie temperature, the K dielectric constant, the FD dielectric dissipation factor, the DC electric resistivity and the Kp planar electromechanical coupling factors and the thickness factors are compared to those obtained with the PZT pure sintered at 1200/sup 0/C. (E.G.).

31281 (INIS-BR–1531) **Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/superconductor compound.** Torres V, G.; Moreno, J.E. Associacao Latino-Americana de Metalurgia e Materiais, Rio de Janeiro, RJ (Brazil). 1988. 7p. (In Portuguese). (CONF-8811214–: 3. Latin-American colloquium about fatigue and fracture of materials, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1988). Order Number DE89613395/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The high temperature superconductor YBa/sub 2/Cu/sub 3/O/sub 7-x/shown a brittle behavior when deformed under ambient conditions. If a hydrostatic state of stress is imposed with a metal matrix, it is possible to induce exttended plastic deformations as a great as 200% were achieved using this method without loosing the superconductivity in the ceramic. The observed deformations mechanisms are similar to those observed in the superplastic metals and the boundary ceramic metal matrix was found to be highly coherent. This method opens a new technique that can be apllied in the manufacture of superconductor wire.

31282 (INIS-BR–1533) **Factors affecting stress distribution and displacements in crystals III-V grown by Czochralski method with liquid encapsulation.** Schvezov, C.E.; Samarasekera, I.; Weinberg, F. Associacao Latino-Americana de Metalurgia e Materiais, Rio de Janeiro, RJ (Brazil). 1988. 20p. (In Spanish). (CONF-8811214–: 3. Latin-American colloquium about fatigue and fracture of materials, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1988). Order Number DE89613396/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A mathematical model based on the finite element method for calculating temperature and shear stress distributions in III-V crystals grown by LEC technique was developed. The calculated temperature are in good agreements with the experimental measurements. The shear stress distribution was calculated for several environmental conditions. The results showed that the magnitude and the distribution of shear stresses are highly sensitive to the crystal environment, including thickness and temperature distribution in boron oxides and the gas. The shear stress is also strongly influenced by interface curvature and cystals radius.

31283 (LBL–27094) **Microanalytical and structural characterization of optical materials by electron microscopy and related spectroscopies.** Krishnan, K.M. Lawrence Berkeley Lab., CA (USA). Apr 1989. 20p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890426–14: Spring meeting of the Materials Research Society, San Diego, California, USA, 24-28 Apr 1989). Order Number DE89012589/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The fine probe forming capabilities of an analytical electron microscope combined with the development of related spectroscopies, diffraction and imaging techniques, makes it possible to obtain structural and chemical information from multiphase materials at high spatial resolution. These microanalytical methods are described with relevant examples from our studies of compounds in the Al_2O_3-AlN pseudobinary system, a potential window material, low-pressure synthesized diamond, diamond-like carbon and hydrocarbon films. A comprehensive example of the characterization of a novel AlON poltypoid structure (32H), illustrative of both the information content obtainable from these techniques at any particular level of resolution and the need to employ all the complementary methods of analysis, is discussed. Efforts to characterize a variety of diamond-like carbon films by the measurements of both the low-loss plasmon resonances and the fine structure in the core-loss edges observable in the energy-loss spectrum, to obtain sp^3/sp^2 ratios are outlined. The electronic structure of thin film diamonds, synthesized by a plasma enhanced chemical vapour deposition method, has been shown to be in agreement with band structure calculations. 23 refs., 12 figs.

31284 (NRCC/IMR–28898) **Interaction of plasma-sprayed YBa/sub y/Cu/sub 3/0/sub x/coatings with alumina substrates.** Moreau, C.; Parent, L.; Dallaire, S.; Champagne, B. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. [1989]. 22p. (MICROLOG–89-00453). Available from Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Superconducting YBa/sub 2/Cu/sub 3/O/sub x/coatings can be obtained by plasma spraying. Since the as-sprayed coatings do not have an appropriate crystalline structure and are not superconducting, a thermal treatment must be done for crystallizing them in the appropriate YBa/sub 2/Cu/sub 3/O/sub x/phase. During heat treatment, reactions between the substrate and coating occur and in some cases, may prevent superconducting properties to be obtained. In the present study, YBa/sub 2/Cu/sub 3/O sub/x/coatings have been deposited on alumina substrates by plasma spraying and heat treated under flowing oxygen at 950/sup 0/C for different periods of time. The modification in coating microstructure has been

investigated after different heat treatments. A degradation mechanism of superconducting coatings is proposed. 14 refs., 7 figs., 2 tabs.

31285 (PB–89-859896/XAB) **Ceramics technology: automotive gas-turbine-engine component applications. January 1976-April 1989 (Citations from the NTIS data base). Report for January 1976-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 62p. Available from NTISPC N01/MF N01.

Supersedes PB–88-857388.

This bibliography contains citations concerning ceramic materials that are resistant to heat, wear, and corrosion processes, and their utilization in automobile engines. Fabrication techniques for ignition-system components, combustion chamber parts, gas-path seals, turbine rotors, stators, nozzles, blades, and heat exchangers are discussed. Ceramic/metal composites suitable for automotive gas-turbine engine components are also considered. (This updated bibliography contains 102 citations, 12 of which are new entries to the previous edition.)

31286 (PB–89-860175/XAB) **Thermal-insulating coatings. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 60p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the properties and applications of thermal-insulating coatings. Topics include ceramic coatings, infrared reflective coatings, and low permeability coatings. Applications of thermal-barrier and reflective coatings to pipes, cables, turbines, automobile glass, windows, concrete, brick, and metals are presented. Performance evaluations of thermal coatings are included. (Contains 125 citations fully indexed and including a title list.)

31287 (SAND–88-1112C) **Ceramic joining in the United States.** Loehman, R.E. Sandia National Labs., Albuquerque, NM (USA). 1988. 11p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-8804256–1: Conference on interfaces and ceramic joining, Petten, Netherlands, 20 Apr 1988). Order Number DE89009323/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Most US government-funded ceramic joining research and development is sponsored by the US Department of Energy (DOE). Historically, this work has not been funded as a stand-alone effort, but rather as a component of the ceramic engine program sponsored by DOE. That program had its genesis with the Advanced Gas Turbine or AGT Project, which was conducted by two teams, each consisting of a turbine manufacturer and an automobile company. Those two teams, Garrett/Ford and GM/Allison, eventually produced gas turbine demonstration engines in two designs that ran for 100 hours at 1150 °C. An important point for this audience is that the program included no separate materials development or joining R and D. The project objective was engineering design and demonstration and new materials and processes to meet the systems requirements were to be developed as needed in the program. Consequently, there was very little support for advanced materials development and progress on that front was somewhat limited. 6 refs.

31288 Fracture mechanics of crack branching in ceramics. Kirchner, H.P. (Ceramic Finishing Co., State College, PA (US)); Conway, J.C. Jr. v.v of Fractography of glasses and ceramics. Frechette, V.D.; Varner, J.R. American Ceramic Society Inc., Westerville, OK (1988). (CONF-8608230–: Fractography of glasses and ceramics, Alfred, New York, USA, 3-6 Aug 1986).

Criteria for predicting the shapes and locations of crack-branching boundaries in a particular material and the effect of variations of material properties on the crack-branching behavior under other conditions or for other materials are needed to understand the fracture mechanics of crack branching. The shapes and locations of crack-branching boundaries in rectangular and cylindrical glass specimens fractured at various stresses in tension and flexure were compared with boundaries predicted using the stress intensity and Johnson and Holloway (J and H) criteria. The stress intensity criterion yielded better predictions than the J and H criterion, which does not account for the surface effect and predicts boundaries that are crowded toward the surface compared with the predictions of the stress intensity criterion and the experimental boundaries. A total crack-tip strain criterion was proposed to compare crack branching within groups of ceramic materials. This criterion is based on a correlation between the overloading (K/sub B//K/sub IC/) at branching and the brittleness (H/K/sub IC/) where H is the hardness. The intercept and the slope were interpreted in terms of a branching mechanism.

31289 Laser-initiated chemical vapor etching of ceramics. Johnson, A.W. (Sandia National Labs., Albuquerque, NM (US)); Smilgys, R.V. v.v of Laser chemical processing of semiconductor devices. Extended abstracts. Houle, F.A.; Deutsch, T.F.; Osgood, R.M. Jr. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

Lasers can be used to remove the surface of ceramic materials with a high degree of spatial localization. Often the hardness of ceramics (e.g., titanium diboride and titanium carbide) makes it difficult to shape the object after it has been sintered or deposited at high temperatures. A cw argon ion laser can locally heat the surface and induce the oxidation of the ceramic in an halogen atmosphere. In particular, the authors have used the 514-nm line of an Ar/sup +/ laser to induce the chemical etching of TiB/sub 2/and TiC in a few Torr of chlorine gas. At high laser intensity, the etching rate is limited by diffusion of the chlorine to the surface and at low laser intensity the etching rate is limited by the surface temperature. In the temperature limited regime, the coefficient in the exponent of an Arrhenius fit gives an activation energy of about 1.0 eV.

31290 Fractographic determination of crack-tip stress intensity. Michalske, T.A. (Sandia National Labs., Albuquerque, NM (US)); Collins, J.M. v.v of Fractography of glasses and ceramics. Frechette, V.D.; Varner, J.R. American Ceramic Society Inc., Westerville, OK (1988). (CONF-8608230–: Fractography of glasses and ceramics, Alfred, New York, USA, 3-6 Aug 1986).

The mechanical properties of ceramic materials are largely controlled by surface flaws. These strength-limiting flaws often possess complex geometries, which do not lend themselves to stress-intensity determinations by either analytical of finite-element techniques. An experimental technique for measuring stress intensity at all points along a propagating surface crack is presented in this paper. By this technique, a crack was propagated incrementally from the surface defect of interest by a pulsed load. The distance between arrest lines generated on the fracture surface was used to calculate the local crack velocity. Crack-velocity measurements were substituted into a known K/sub 1/vs V relationship to obtain instantaneous stress-intensity measurements at various points along the growing crack. This experimental technique was used to determine stress intensities for indentation-induced surface flaws in glass. Experimental results were compared with several finite-element calculations for semielliptical surface flaws. The comparisons shows good agreement between finite-element results and experimentally determined stress-intensity values for cracks in glasses.

31291 Characterization of processing flaws in beta alumina. McEntire, B.J. (Ceramatec, Inc., Salt Lake City, UT (US)); Snow, R.H.; Huang, J.L.; Viswanathan, L.; Virkar, A.V. v.v of Fractography of glasses and ceramics. Frechette, V.D.; Varner, J.R. American Ceramic Society Inc., Westerville, OK (1988). (CONF-8608230–: Fractography of glasses and ceramics, Alfred, New York, USA, 3-6 Aug 1986).

Beta-alumina ceramics, prepared from several powder processing routes and sintered into polycrystalline tubular shapes, possess varying types of process-induced flaws which can lead to mechanical or electromechanical failure during operation. Using a mechanical testing technique known as burst-testing, electrolyte tubes produced from mechanically-mixed, spray-dried, and zirconia-dispersed powders were subjected to a uniform internal hoop stress until failure. From the fracture patterns on each electrolyte, critical flaws associated with failure were identified. In general, these failure origins were comprised of voids, or voids associated with large grains. For mechanically-mixed and zirconia-toughened compositions, impurities were present at the flaw site and were contributing

factors to failure. Electrolyte tubes produced from spray-dried powders possessed fewer large flaws and were generally free of impurities. Optimized processing of these materials resulted in hoop strength values of between 130 and 180 MPa, with fracture toughness values of between 1.8 and 3.6 MPa.m/sup 1/2/, and Weibull moduli up to 13.

31292 An XPS study of the passivity of an amorphous Co-20P alloy. Diegle, R.B. (Sandia National Labs., Albuquerque, NM (US)); Helfand, M.A.; Clayton, C.R. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

The authors have compared the anodic behavior of amorphous Co-20P alloy to that of amorphous Ni-20P, with which it may be considered a compositional analog. Specifically, similarities in the superimposed E-pH diagrams for a) Ni-H/sub 2/O and P-H/sub 2/O and b) Co-H/sub 2/O and P-H/sub 2/O suggested that Co-20P may passivate in a manner similar to Ni-20P. Anodic polarization experiments in 0.2N H/sub 2/SO/sub 4/and 0.2N HCl electrolytes show that amorphous Co-20P alloy passivates at potentials between -0.3 V and 0.2 V(SCE) and dissolves transpassively above 0.2 V(SCE) in agreement with the reported behavior of Ni-20P. In 0.2N HCl, in which crystalline Co dissolves readily, Co-20P resists pitting and passivates as effectively as in 0.2N H/sub 2/SO/sub 4/. Analysis by x-ray photoelectron spectroscopy of Co-20P surfaces after polarization (presented below) indicates an enrichment of elemental P on the alloy surface, the presence of hypophosphite ions and the absence of oxidized cobalt species. Thus, the Co-20P alloy does not passivate by development of a tree-dimensional oxide film. A chemical passivation process, identical to that which was observed on amorphous Ni-20P surfaces is proposed that is controlled by the formation and surface retention of a hypophosphite anion which acts as a barrier between the alloy and the electrolyte. This barrier presents the electrochemical reaction of Ni by preventing hydration of surface atoms, which is the first step in its oxidation. Cobalt, unlike nickel, does not exhibit a wide potential range of passivity in acidic or basic electrolyte; therefore, the influence of P on passivity is more evident than if it is in the Ni-20P system.

31293 Photoelectrochemistry and photochemistry of sensitized semiconductor surfaces. Spitler, M.T. (Mount Holyoke College, South Hadley, MA (US)); Ryan, M.A. v.v of Proceedings of the 1987 Electrochemical Society spring meeting: Extended abstracts. Volume 87-1. The Electrochemical Society, Pennington, NJ (1987). (CONF-870560–: 171. Electrochemical Society meeting, Philadelphia, Pennsylvania, USA, 10-15 May 1987).

The photocurrent-voltage curves for the dye eosin at TiO/sub 2/ single crystal electrodes were compared with the bleaching of the dye's singlet absorption at 514 nm. The extent of bleaching of the dye layer was equal to the .1% quantum yield for photocurrent production. Although there is a linear correlation between the photocurrent and the photobleaching, there does appear to be a significant bleaching of the dye which does not result in photocurrent. This component of the bleaching signal disappears with the presence of hydroquinone in the electrolyte as does the absorption signal of the radical oxidized dye. The decay of absorption by the radical is dependent on the electrode potential and is determined by the rate of back reaction between injected electrons and the acceptor radical. Novel photochemical methods were explored for the attachment of the dye layer to these oxide semiconductors.

31294 Raman spectroscopic observation of laser-induced oxidation of transition-metal borides, carbides, and nitrides. Begun, G. M. (Chemistry Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, Tennessee 37831-6110(US)); Bamberger, C. E. *Applied Spectroscopy (USA),* 43(1): 134-137 (Jan 1989). DOE Contract AC05-84OR21400.

Laser Raman microprobe examination in air of small-particle-sized(powders and whiskers) TiN, TiB_2, TiC, WC, ZrN, and NbN revealedthe formation of surface oxides, which were induced by laser heating. Therate of oxide formation varied with the particle size of the samples andthe laser power density applied. The oxides produced were characterizedby their Raman spectra. Thus, the Raman spectra obtained with a microprobeshould always be carefully analyzed to ascertain whether oxidation ordecomposition of so-called inert materials, especially in powder form, hasoccurred.

31295 Crystal structure of aluminum molybdate, $Al_2(MoO_4)_3$, determined by time-of-flight powder neutron diffraction. Harrison, W.T.A. (Univ. of Oxford (England)); Cheetham, A.K.; Faber, J. Jr. *Journal of Solid State Chemistry (USA),* 76(2): 328-333 (Oct 1988). DOE Contract W-31-109-ENG-38.

The room temperature crystal structure of aluminum molybdate, $Al_2(MoO_4)_3$, was refined using time-of-flight powder neutron diffraction data. It is monoclinic, with a = 15.3803(9) Å, b = 9.0443(1) Å, c = 17.888(1) Å, and β = 125.382(3)°, space group $P2_1/a$. It is isostructural with $Fe_2(MoO_4)_3$ and $Cr_2(MoO_4)_3$. The application of the Rietveld method to complex structures is discussed.

31296 Chemical vapor deposition of $YBa_2Cu_3O_{7-x}$ superconducting films. Dickinson, P. H. (Applied Physics Department, Stanford University, Stanford, California 94305(US)); Geballe, T. H.; Sanjurjo, A.; Hildenbrand, D.; Craig, G.; Zisk, M.; Collman, J.; Banning, S. A.; Sievers, R. E. *Journal of Applied Physics (USA),* 66(1): 444-447 (1 Jul 1989). DOE Contract AC05-88ER80642.

Superconducting thin films of $YBa_2Cu_3O_{7-x}$ have been producedby chemical vapor deposition. Volatile coordination compound precursors of theoxide components, β-diketonates of Y, Ba, and Cu, are thermally decomposed onhot substrates to form crystalline films. The Ba compound was evaporated in thepresence of externally added vapors of the β-diketonate to obtain steadyevaporative behavior. Superconducting films were obtained on $SrTiO_3$substrates at temperatures above 800 °C. The best films have onsettemperatures of 90 K and loss of resistance as high as 68 K. Epitaxial growthwas obtained.

31297 Observation of crystallographic texture and J/sub c/ anisotropy in bulk shock-compacted YBa/sub 2/Cu/sub 3/O/sub 7-x/powders. Johnson, K.A. (Los Alamos National Lab., Los Alamos, NM (US)); Staudhammer, K.P.; Medina, W.J.; Elliott, N.E.; Pierce, C.B. *Scripta Metallurgica (USA),* 22(10): 1689-1693 (Oct 1988).

Preferred orientation in bulk sinter/forged YBa/sub 2/Cu/sub 3/O/sub 7-x/has been observed. The authors report here the observation of similar anisotropy in bulk YBa/sub 2/Cu/sub 3/O/sub 7-x/ prepared by several other methods: shock compaction, cold pressed powder, and conventional pressed/sintered powders.

31298 The use of heteroepitaxy in the fabrication of bicrystals for the study of grain boundary structure. Dahmen, U. (National Center for Electron Microscopy, MCSD, Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)); Westmacott, K.H. *Scripta Metallurgica (USA),* 22(10): 1673-1678 (Oct 1988).

Experiments on grain boundary structure can be grouped into two categories - those that provide limited structural information on a large number of boundaries and those that give detailed structural information on a limited sampling of boundaries. The first category is typified by the elegant Rotating-Sphere-On-Plate experiments. In this technique single crystal spheres are placed in a random array on a single crystal plate and annealed to promote their relaxation into low-energy orientations. The resulting orientation distribution is recorded in an X-ray pole figure and, assuming all boundary planes are parallel to the plate surface, statistically significant data on misorientation and type of boundary (twist/tilt, symmetrical/asymmetrical) can be obtained rapidly. However, this macroscopic method does not give any direct information on the grain boundary structure. At the other extreme, detailed investigations of the structure of individual grain boundaries have been carried out using transmission electron microscopy. High-resolution observations have revealed the atomic structure of special grain boundaries in semiconductors, and ceramics, but the difficulty of sample preparation has severely limited the number of experimental analyses of such boundaries. Until quite recently an additional problem hindering the study of the close-packed structure of metals has been the resolution limit of available microscopes. Thus only a few examples of the detailed grain boundary structure in metals have been reported.

31299 Multifractal fracture. Williford, R.E. (Pacific Northwest Lab., Richland, WA (US)). *Scripta Metallurgica (USA),* 22(11): 1749-1754 (Nov 1988).

This paper discusses the relationship between fracture energies and the fractal dimensions (D/sub s/) of fracture surfaces. Fractal dimensions provide a means to describe complicated geometries in terms of transitions between the integer-valued Euclidean dimensions. For fracture surfaces, D/sub s/is between 2 and 3 because the surface features (i.e., the roughness R) extend from the two-dimensional mean plane of the surface into the third dimension. It has generally been found that a greater R results in greater D/sub s/. Only single dimensions have been used in previous applications of fractals to fracture problems. The purpose of this paper is to propose an explanation for this negative correlation based on the above spectrum of dimensions. This spectrum is part of a recent extension of the fractal concept: multifractals. In the following, a brief description of the multifractal concept provides a new understanding of the correlation (ordering) between the energetics of various fracture mechanisms and the complicated geometries of material damage. This ordering is quantified by a multifractal fracture model that is based on a partitioning of fracture mechanisms into two basic types: ductile (shear) or brittle (tensile). Interactive mechanisms in heterogeneous materials (composites) are implicitely included in the model, and a method for model verification by comparison to measured values of D/sub s/is demonstrated.

31300 Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals. Shi, D. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439(US)); Tang, M.; Chang, Y. C.; Jiang, P. Z.; Vandervoort, K.; Malecki, B.; Lam, D. J. *Applied Physics Letters (USA),* 54(23): 2358-2360 (5 Jun 1989). DOE Contract W-31-109-ENG-38.

The transport crystal current density J_c has been measured in$Bi_2Sr_2CaCu_2O_x$ single crystals. With a voltage criterion of 1.0μV/cm, current density measurements yield J_c values ranging from300 to 1000 A/cm^2 at 77 K and zero field, depending upon crystal quality. Thecrystals are grown by using a flux method and have a typical size ofapproximately 10×4×1.5 mm. X-ray diffraction, scanning electron microscopy,electrical resistivity, and magnetization shielding data are reported.

31301 Coupling strengths and flux pinning in oxide superconductors. Lichti, R. L. (Texas Tech University, Lubbock, Texas 79409(US)); Chan, K. C. B.; Cooke, D. W.; Boekema, C. *Applied Physics Letters (USA),* 54(23): 2361-2363 (5 Jun 1989).

Muon spin relaxation measurements have been performed to obtain penetrationdepth versus temperature for several high-temperature oxide superconductors.Comparison with theoretical results based on the Eliashberg equations indicatesthat at 1 kOe the (*RE*)$Ba_2Cu_3O_7$ materials (data for *RE*=Gd,Er, and Eu) are in the very strong coupling, extremely dirty limit, while dataat 5 kOe for $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$ follow thestrong coupling, clean limit curve.

31302 High-energy oxygen phonon modes and superconductivity in $Ba_{1-x}K_xBiO_3$: An inelastic-neutron-scattering experiment and molecular-dynamics simulation. Loong, C. (Intense Pulsed Neutron Source, Argonne National Laboratory, Argonne, Illinois 60439(US)); Vashishta, P.; Kalia, R. K.; Degani, M. H.; Price, D. L.; Jorgensen, J. D.; Hinks, D. G.; Dabrowski, B.; Mitchell, A. W.; Richards, D. R.; and others. *Physical Review Letters (USA),* 62(22): 2628-2631 (29 May 1989). DOE Contract W-31-109-ENG-38.

Phonon densities of states of insulating $BaBiO_3$ and superconducting $Ba_{0.6}K_{0.4}BiO_3$ are determined by neutron-scattering experiments. The main peaks in $BaBiO_3$ occur at 35, 43, 63, and 71 meV. In $Ba_{0.6}K_{0.4}BiO_3$, the phonon spectrum softens and is comprised of two bands around 30 and 60 meV. Molecular-dynamics results, which are in good agreement with the experiment, reveal that the observed phonon peaks are due to oxygen vibrations. The softening of oxygen phonon modes around 30 and 60 meV is due to electron-phonon coupling, indicating that $Ba_{0.6}K_{0.4}BiO_3$ is a normal BCS superconductor.

31303 Structural phase transformations and superconductivity in $La_{2-x}Ba_xCuO_4$. Axe, J. D. (Brookhaven National Laboratory, Upton, New York 11973(US)); Moudden, A. H.; Hohlwein, D.; Cox, D. E.; Mohanty, K. M.; Moodenbaugh, A. R.; Xu, Y. *Physical Review Letters (USA),* 62(23): 2751-2754 (5 Jun 1989). DOE Contract AC02-76CH00016.

$La_{2-x}Ba_xCuO_4$ has been found toundergo the following sequence of transformations upon cooling:tetr.(*I*4/*mmm*)→ortho.(*Bmab*)→tetr.($P4_2$/ncm), over arange of composition $0.05<x<0.20$. The newlydiscovered low-temperature tetragonal phase can be thought of as a*coherent* superposition of the twin-related *Bmab* structures. Thesystem can be modeled as an *XY*-spin system with temperature-dependentquartic anisotopy, $\nu(T)$. Slight differences between orthorhombic andtetragonal structures appear to have large effects upon the superconductivity.

31304 X-ray-absorption study of the interaction of hydrogen with clusters of supported palladium. Davis, R. J. (Department of Chemical Engineering, Stanford University, Stanford, California 94305(US)); Landry, S. M.; Horsley, J. A.; Boudart, M. *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 10580-10583 (15 May 1989).

The extended x-ray-absorption fine structure (EXAFS) and x-ray-absorption near-edge structure (XANES) at the Pd *K* edge were used to observe the interaction of hydrogen with palladium clusters, 5 nm in average size, supported on alumina. A sample was reduced in flowing dihydrogen at 573 K and atmospheric pressure. This sample was then cooled to room temperature (RT) in dihydrogen, allowing for the formation of β-phase palladium hydride. Another sample was reduced in the same way, but then evacuated at 573 K to prevent formation of the hydride. This sample was cooled to RT *in vacuo* and contacted with helium at atmospheric pressure. Analysis of the Pd EXAFS recorded at RT showed a 3.7% increase in the Pd-Pd distance and greater disorder for the hydride compared to the sample free of hydride. The XANES results were consistent with a narrowing of the L_3=1 band features for the hydride sample due to the increased Pd-Pd distance. In addition, the line shape of the edge for the hydride may result from hydrogen lowering the number of unoccupied *p*-like states near the Fermi level of Pd. The observed lattice expansion and modified electronic structure have been reported for bulk palladium hydride.

31305 Pressure dependence of the superconducting and Neel temperatures in a $La_2CuO_{4+\delta}$ crystal. Aronson, M. C. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Cheong, S.; Garzon, F. H.; Thompson, J. D.; Fisk, Z. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11445-11448 (1 Jun 1989).

We have measured the temperature dependence of the resistance for a $La_2CuO_{4+\delta}$ single crystal at pressures from 1 bar to 18 kbar. The effects of pressure on the antiferromagnetic transition temperature T_N and the superconducting transition temperature T_c are compared to those of oxygen doping.

31306 Flux creep in Y(Gd)$Ba_2Cu_3O_{7-\delta}$: Magnetic field dependence. Foldeaki, M. (Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139(US)); McHenry, M. E.; O'Handley, R. C. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11475-11481 (1 Jun 1989).

The time-dependent decay of the diamagnetic magnetization was measured after zero-field cooling (ZFC) over a broad range of fields and temperatures. The time dependence was found to be linear for short times and logarithmic thereafter within the experimental time intervals for all fields and temperatures. The relaxation rates $A(H_0,T)$ and $A(H,T_0)$ show maxima at T_m and H_m, respectively (where T_0 and H_0 are constant values). The shape of $A(H,T_0)$ is more complicated than that of $A(H_0,T)$, which is nearly symmetrical around T_m. Increasing H_0 or T_0 decreases H_m or T_m. The activation parameters were found to be strongly field dependent, whereas they agree well for both investigated compositions. The activation energy decreases with increasing field, following the empirical law: $Q=a+b/H^2$. The frequency factor distribution broadens with increasing H, which can be described by the following empirical expression: $\ln(\tau_{02}/\tau_{01})=d-g/H$. Using the activation parameters as determined from $A(H_0,T)$ and interpolating by the above expressions, the relaxation rate $A(H,T_0)$, can be calculated and agrees well within the experimental data within the experimental error. The data are interpreted using the theoretical model of Beasley,

Labusch, and Webb on thermally activated flux creep over pinning centers assisted by the field-dependent driving force.

31307 Nonlinear electrodynamics in the granular superconductor $YBa_2Cu_3O_7$: Experiments and interpretation. Jeffries, C. D. (Physics Department, University of California, Berkeley, California 94720(US)); Lam, Q. H.; Kim, Y.; Kim, C. M.; Zettl, A.; Klein, M. P. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11526-11537 (1 Jun 1989). DOE Contract AC03-76SF00098.

For bulk samples of superconducting $YBa_2Cu_3O_7$ powder and pellets subject to a dc magnetic field H_0 and a parallel ac magnetic field H_1 at frequency $f \approx 10^3$ to 10^5 Hz, we report data on the generated harmonic power $P(nf)$ up to harmonic $n \approx 40$, finding: (1) If $H_0=0$, only odd harmonics; (2) if $H_0 \neq 0$, even harmonics are additionally generated; (3) for H_1 sufficiently large ($\gtrsim 10$ Oe) and n large, then $P(nf)$ vs H_0 displays sharp and deep periodic dips, revealing a remarkably consistent and reproducible macroscopic flux quantization for the bulk sample. These data, as well as the relative intensities of the harmonic power, are found to be in semiquantitative agreement with detailed numerical predictions of a dynamical model of the material as a suitably averaged ensemble of prototype flux quantized loops with weak links. At lower values of H_1 additional structure is observed, related to fluxon pinning and depinning.

31308 Distorted chain sites for Co- and Fe-substituted $YBa_2Cu_3O_{7-\delta}$. Bridges, F. (Department of Physics, University of California, Santa Cruz, California 95064(US)); Boyce, J. B.; Claeson, T.; Geballe, T. H.; Tarascon, J. M. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11603-11617 (1 Jun 1989).

We present x-ray-absorption fine-structure (XAFS) measurements for a series of Co- and Fe-substituted samples of $YBa_2Cu_3O_{7-\delta}$(Y-Ba-Cu-O). Our analysis of the first- and second-neighbor environments indicates that the Co atoms primarily replace the Cu in the chain sites, the Cu(1) atoms, in Y-Ba-Cu-O, but many of these Co(1) sites and their neighboring oxygen sites are highly distorted. The first-neighbor Co-O peak consists of ~3.5 oxygen at 1.8 A and ~1.3 oxygen at 2.4 A, while the second-neighbor multipeak in the XAFS data is unexpectedly low in amplitude. Structure in this peak is inconsistent with a simple Gaussian broadening and indicates that several Co(1)-Ba distances exist. We propose an aggregation of the Co atoms into distorted, zigzag chains along the ⟨110⟩ directions, with some of the Co displaced off center by ~0.4 A along a perpendicular ⟨110⟩ direction. This model is consistent with the second-neighbor XAFS data, provides an explanation for the tetragonal structure via twinning on a microscopic scale, and accommodates excess oxygen within the Co chains. The Fe data suggest that similar chains also exist in the Fe-substituted samples. There are, however, some differences between the local environments of the Fe and Co. The primary difference is that a small but significant number of Fe atoms occupy the Cu(2) plane sites while no appreciable number of Co atoms are found on the Cu(2) sites in the more dilute samples. Finally, near-edge measurements on the Co and Fe *K*-absorption edges indicate that the valence is primarily +3, but a mixture of valences exists. For Co the edge position corresponds to a mixture of +2 and +3 valences, while Fe exists in a mixture of +2, +3, and +4 states.

31309 Specific heat of $Bi_2Sr_2CuO_6$ and $Bi_2Sr_2CaCu_2O_8$ in the superconducting state. Chakraborty, A. (Department of Physics, The Ohio State University, Columbus, Ohio 43210-1106(US)); Epstein, A. J.; Cox, D. L.; McCarron, E. M.; Farneth, W. E. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 12267-12270 (1 Jun 1989).

We have measured the specific heat $C(T)$ of single phase samples of the cuprate superconductors $Bi_2Sr_2CuO_{6-\delta}$ (2:2:0:1; T_c=12.5 K) and $Bi_2Sr_2CaCu_2O_{8-\delta}$ (2:2:1:2; T_c=84 K) in the temperature range 3–11 K. Bulk superconductivity with a Meissner fraction of about 25% is observed for both materials. We find no strong evidence for a term in $C(T)$ linear in the temperature T; rather, $C(T)/T$ is a linear function of T^2 in this temperature range. A least-squares fit gives an upper bound of 0.35 mj/Cu K^2 for any linear term. This result appears to rule out gapless pairing and gap functions with lines of nodes in these materials. Though gap functions with point nodes are not excluded by our results, we demonstrate that possibility to be unlikely in these materials. We suggest further experiments to test whether such T^3 electronic contribution to the specific heat exists for the 2:2:0:1 material.

31310 Fluctuation conductivity of Tl-Ba-Ca-Cu-O thin films. Kim, D. H. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455(US)); Goldman, A. M.; Kang, J. H.; Gray, K. E.; Kampwirth, R. T. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 12275-12278 (1 Jun 1989). DOE Contract W-31-109-ENG-38.

Measurements of the in-plane fluctuation-enhanced conductivity of *c*-axis oriented Tl-Ba-Ca-Cu-O thin films have been performed over the temperature range T_c to 240 K. The results were consistent with two-dimensional fluctuation theory and with a linear dependence of the normal resistivity on temperature down to $(T-T_c)/T_c \approx 0.03$. A crossover to three-dimensional fluctuations close to T_c was not found. The width of the superconducting transition appears to be a measure of a distance over which layers fluctuate in a correlated manner.

31311 X-ray study of in-plane epitaxy of $YBa_2Cu_3O_x$ thin films. Budai, J. D. (Solid State Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, Tennessee 37831-6024(US)); Feenstra, R.; Boatner, L. A. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 12355-12358 (1 Jun 1989). DOE Contract AC05-84OR21400.

Detailed x-ray scattering measurements in three dimensions are reported for thin $YBa_2Cu_3O_x$ films on (001) $SrTiO_3$ and $KTaO_3$ substrates. The films, produced by coevaporation followed by a postdeposition anneal, consist of domains epitaxially oriented with either the *a* axis or the *c* axis aligned with the substrate normal. The in-plane epitaxy of grains with the *c* axis parallel to the normal shows an alignment of the ⟨110⟩ directions of the film and the substrate, rather than of the ⟨100⟩ directions as is generally presumed. We associate this alignment with a strain relaxation during the high-temperature tetragonal-to-orthorhombic phase transition.

31312 Preparation and Raman analysis of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$. Radousky, H. B. (Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, California 94550(US)); McCarty, K. F.; Peng, J. L.; Shelton, R. N. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 12383-12386 (1 Jun 1989). DOE Contract W-7405-ENG-48.

A series $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ materials with $0 \leq x \leq 1$ have been prepared that do not show phase separation and have sharp superconducting transitions for $x \leq 0.45$. These samples have been characterized by x-ray diffraction, resistivity, field-cooled magnetization, and thermogravimetric analysis. Raman spectra have been obtained for the entire series, including the nonsuperconducting regions. The O(4) stretching mode at ~500 cm^{-1} is seen to harden by 15 cm^{-1}, while the Cu(2)-O(2,3) out-of-phase bending mode at ~340 cm^{-1} is seen to soften by 40 cm^{-1} on going from $YBa_2Cu_3O_7$ to $PrBa_2Cu_3O_7$. These changes fall on a universal curve for the Raman shifts of all the compounds $RBa_2Cu_3O_7$ (*R*=rare earth) as a function of the radii of the rare-earth ions. No abrupt changes in the Raman shifts are observed at x=0.5, where the superconductivity is destroyed.

31313 Low-temperature specific heat of single-crystal $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$. Urbach, J. S. (Department of Applied Physics, Stanford University, Stanford, California 94305(US)); Mitzi, D. B.; Kapitulnik, A.; Wei, J. Y. T.; Morris, D. E. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 12391-12394 (1 Jun 1989).

We report specific-heat measurements from 2 to 15 K on single crystals of $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$ We find low-temperature deviations from the Debye law that can be attributed to spin-glass behavior of a small concentration of isolated impurity copper moments. At higher temperatures, we observe contributions to the specific heat that can be attributed to a soft-phonon mode, possibly associated with the superstructure in the Bi-O and Tl-O layers. From our single-crystal data, we conclude that the thallium- and bismuth-based copper oxide superconductors show no measurable linear term in the specific heat [$\gamma(0) \leq 1$ mJ/mole K^2].

3606 Other Materials

Refer also to citation(s) 30272, 30322, 30407, 30454, 30455, 30618, 30758, 30771, 31052, 31092, 31112, 31175, 31200, 31213, 31228, 31234, 31235, 31275, 31283, 31286, 31298, 31486, 31545, 31622, 31647, 31662, 31665, 32404, 32929

31314 (AD-A–204233/1/XAB) **Characterization of mechanical damage mechanisms in ceramic composite materials. Technical report, 23 May 1987-24 May 1988.** Lankford, J. Southwest Research Inst., San Antonio, TX (USA). Sep 1988. 44p. (SWRI–8124). Available from NTIS, PC A03/MF A01.

High-strain-rate compressive failure mechanisms in fiber-reinforced ceramic-matrix composite materials were characterized. These are contrasted with composite damage development at low-strain rates, and with the dynamic failure of monolithic ceramics. It is shown that it is possible to derive major strain-rate strengthening benefits if a major fraction of the fiber reinforcement is aligned with the load axis. This effect considerably exceeds the inertial microfracture strengthening observed in monolithic ceramics, and non-aligned composites. Its basis is shown to be the trans-specimen propagation time period for heterogeneously-nucleated, high-strain kink bands. A brief study on zirconia focused on the remarkable inverse strength-strain rate result previously observed for both fully and partially-stabilized zirconia single crystals, whereby the strength decreased with increasing strain rate. Based on the hypothesis that the suppression of microplastic flow, hence, local stress relaxation, might be responsible for this behavior, fully stabilized (i.e., non-transformable) specimens were strain-gaged and subjected to compressive microstrain. The rather stunning observation was that the crystals are highly microplastic, exhibiting plastic yield on loading and anelasticity and reverse plasticity upon unloading. These results clearly support the hypothesis that with increasing strain rate, microcracking is favored at the expense of microplasticity.

31315 (AERE-R–13349) **Study of defect centres in irradiated optical fibre glasses by electron spin resonance spectroscopy.** Dalgarno, B.G.; Norris, J.O.W.; Tribble, M.J. UKAEA Harwell Lab. (UK). Materials Development Div. Mar 1988. 64p. Available from H.M. Stationery Office, London, price Pound 12.00.

This report is primarily a critical literature survey on the use of electron spin resonance spectroscopy to study defect centres in optical glasses formed by ionising radiation. The majority of the literature is concentrated on silica based glasses, in particular on intrinsic defects within the silicon-oxygen framework, rather than defects caused by impurity atoms. The various ESR features that have been identified are discussed, together with the proposed models for their structure and the supporting experimental evidence. The dominant features in the ESR spectrum, known as E' defects, arise from an unpaired electron occupying an sp/sup 3/hybrid orbital on a silicon atom which is linked to only three oxygen atoms. Despite the extensive research that has been directed towards these defects there remain anomalies and ambiguities. The review also discusses extrinsic defects in silica based glasses, and defects in heavy metal fluoride glasses, the basis of the recently developed optical fibres that are transparent to 4μm. Correlations between the magnitude of the ESR signal and optical absorption features are discussed in the few instances where they have been established. The report concludes by summarising some of the major uncertainties and ambiguities that remain, and suggesting areas where further research should be pursued.

31316 (CONF-881174–4) **Application of neutron diffraction to the measurement of internal residual strain in the constituents of advanced composites.** Kupperman, D.S.; Majumdar, S. Argonne National Lab., IL (USA). Aug 1988. 5p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Experimental mechanics in manufacturing and quality control; Indianapolis, Indiana, USA; 6-8 Nov 1988. Order Number DE89013183/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The temperature-dependent bulk residual strains in a whisker-reinforced ceramic composite, measured by neutron diffraction, were in reasonable agreement with those computed by using two different stress models. Data acquired as a function of the weight percent of whisker were also in agreement with model calculations. 12 refs., 4 figs.

31317 (CONF-890426–10) **Determination of the mechanical properties of diamond and diamond-like films by the ultra-low load indentation technique.** O'Hern, M.E.; McHargue, C.J.; Clausing, R.E.; Oliver, W.C.; Parrish, R.H. Oak Ridge National Lab., TN (USA). 1989. 6p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. W31RPD-8-P4030. From Spring meeting of the Materials Research Society; San Diego, California, USA; 24-28 Apr 1989. Order Number DE89011569/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Diamond and diamond-like films were characterized with a mechanical properties microprobe (MPM) and compared to a natural IIa diamond and single crystal sapphire characterized by the same method. The diamond films were 125 to 375 μm thick with a fine-grained microstructure (~20-μm-diam grains). The natural diamond was a IIa quality diamond with the [100] axis normal to the surface. The sapphire used had low dislocation density with the c-axis normal to the surface. The diamond-like carbon film (DLC) was rf glow discharge deposited to a thickness of about 0.2 μm. Results of the present study are given and future work is discussed. 8 refs., 5 figs.

31318 (CONF-890435–3) **Thermodynamics and high temperature chemistry of the chemical vapor deposition of diamond films.** Sommer, M.; Smith, F.W. City Coll., New York, NY (USA). Dept. of Physics. 1989. 20p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER45317. From 6. international conference on high temperatures: chemistry of inorganic materials; Gaithersburg, Maryland, USA; 3-7 Apr 1989. Order Number DE89013574/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The chemical vapor deposition of carbon films is analyzed using the thermodynamic quasiequilibrium model and a phase diagram for the carbon-hydrogen system is obtained. When the enhanced etching of graphite by hydrogen is included in the model, a region in the phase diagram where diamond is the only stable solid phase of carbon is predicted, consistent with the experimental results. Details of the model and additional comparisons with experiment are presented. 18 refs., 4 figs.

31319 (DOE/ER/13599–T1) **Nonlinear viscoelastic characteristics of polymeric materials: Final report, September 1, 1986–February 28, 1989.** Clark, S.K. Michigan Univ., Ann Arbor, MI (USA). Coll. of Engineering. Jun 1989. 8p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13599. Order Number DE89012680/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Results are presented from an experimental program in which the interaction of load, time, and temperature were examined on the deformation characteristics of polymeric cords, with particular emphasis on nylon cord used in tire construction. Thermal contraction effects generally tend to be negative on such materials, but can be overridden by applied loads. These factors are described experimentally and efforts are made to explain the basis for then and to provide an analytical framework for their description. 2 refs., 11 figs.

31320 (EFM–880331) **Development of tough ceramics. Final report.** Ghosh, D.; Leo-Miza, L.; Ibrahim, F.Y.; Jacobs, J.; Das Gupta, S. Electrofuel Mfg. Co., Toronto, ON (Canada). 1988. 181p. (MICROLOG–89-01725). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A research and development program has been conducted in the area of zirconia toughened ceramics for structural applications. The program objectives of developing transformation toughened ceramics and processing techniques to produce them have been achieved with successful development of the following materials: yttria modified tetragonal zirconia polycrystals; ceria modified tetragonal zirconia polycrystals; alumina toughened zirconia; zirconia toughened alumina with yttria additions; and zirconia toughened alumina without yttria additions. The process and composition optimization has been carried out to yield products with good density, hardness, and toughness values. Depending on the application, an optimum

combination of properties and cost can be engineered based on data generated in this program. It is suggested that transformation toughened ceramics could have near term applicability in a number of wear and structural applications, such as nozzles, wear parts in engines, and cutting tools. 142 refs., 59 figs., 20 tabs.

31321 (HASYLAB–84-03) **Photoemission from excited states in rare gas solids by combining synchrotronradiation with a laser.** Bernstorff, S. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.). Hamburger Synchrotronstrahlungslabor; Hamburg Univ. (Germany, F.R.). Fachbereich Physik. Sep 1984. 183p. (In German). Order Number DE89774741/JAW. Available from NTIS (US Sales Only), PC A09/MF A01.

A new spectroscopic method has been developed to study excited states in rare gas solids: Excitons and conductionband-states are populated by synchrotron radiation (photon energy hw/sub SR/ =5 - 30 eV). Subsequently electrons from these bound or conduction band-states are excited above the vacuum level of the solid by a pulsed dye laser (hw/sub L/=1.9 - 3.7 eV). This experimental technique was applied to solid Xe, Kr, Ar and Ne. (orig./GSCH).

31322 (INIS-BR–1458, pp. 74) **Study of the effect of natural radiation damage in crystal using thermoluminescence fission track etching and x-ray diffraction.** Amin, Y.M. (Malaya Univ., Kuala Lumpur (Malaysia)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts*. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

NATURAL RADIOACTIVITY/thorium; NATURAL RADIOACTIVITY/uranium; NATURAL RADIOACTIVITY/zircon; ZIRCON/natural radioactivity; ZIRCON/physical radiation effects; ANNEALING; FISSION TRACKS; THORIUM; URANIUM; ZIRCON; THERMOLUMINESCENCE; X-RAY DIFFRACTION

31323 (Juel–2252) **Stress analysis and review of a prestressed concrete reactor pressure vessel of a HTR 500-type.** Wang, T.J.; Altes, J. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung. Dec 1988. 134p. Order Number DE89774744/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

Main aim of this first step of analysis is to test the feasibility of the SMART-code for calculation of PCRV's and to establish the control codes for the finite element analysis. Curved triangular, quadrilateral and membrane shell elements are used. The incremental model in the form of tangential stress-strain law has been chosen as the constitutive model for the concrete. The three parameter failure envelope is used as the failure model of the concrete. For the numerical solution the incremental initial iteration method with constant stiffness is utilized. The creep strain is treated as a linear functional of the stress history and dependent on temperature, humidity and aging. The calculation of the creep behaviour is carried out up to 7 years of operation using the model of SEKI and KAWASUMI. In this model the influence of temperature, humidity and the interaction between them is fully considered. The effects of interaction between temperature and creep with and without humidity's influence are studied and some interesting results are presented. The total creep curves vs time are gained, the deformations of nodal points after 7 years are 1.8 - 5.5 times larger then those of the initial elastic deformation after the first loading. Under the action of prestressing along most parts of the PCRV and under the service condition the main part of the PCRV are in compression. Due to increasing the loading over the operating pressure some parts are cracked and the material behaves nonlinearly. At a loading value of 3.25 times the operating pressure the whole transverse section is fully cracked. For the stage of prestressing, design operating pressure and design limit pressure the vessel behaves elastically. The global safety factory is 1.5 times larger than the design value of 2.25 that shows the conservative design. The analysis method and computer codes, which are used in this review, are confirmed efficiently.

31324 (KU-HCOE-FL2-R–88-28) **Mode locking in overdamped charge-density-wave systems.** Alstroem, P.; Levinsen, M.T. Copenhagen Univ. (Denmark). H.C. Oersted Inst. 1988. 12p. Order Number DE89775032/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

We show that the rich mode-locking structure observed in overdamped charge-density-wave (CDW) systems can be understood in terms of a simple model of driven damped 'particles' without inertia in a non-sinusoidal periodic potential. The analysis shows that the nonchaotic system of a driven overdamped CDW without inertia in general has a 'close-to-chaotic' behavior in an appropriate frequency range. Our results also provide a natural basis for studies of spatially extended CDW systems.

31325 (KU-HCOE-FL2-R–88-29) **Wetted solid - a generalization of Plateau's problem and its implications for sintered materials.** Salamon, P.; Bernholc, J.; Berry, R.S.; Carrera-Patino, M.E.; Andresen, B. Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Exxon Research and Engineering Co., Annandale, NJ (USA); Chicago Univ., IL (USA). Dept. of Chemistry; Chicago Univ., IL (USA). James Franck Inst. 1988. 31p. Order Number DE89775031/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

We introduce a new generalization of the Plateau problem which includes the constraint of enclosing a given region. Physically the problem is important insofar as it bears on sintering processes and on the structure of wetted porous media. Some primal and dual characterizations of the solutions are offered, and aspects of the problem are illustrated in one and two dimensions in order to clarify the combinatorial elements and to demonstrate the importance of numerous local minima.

31326 (KU-HCOE-FL2-R–89-1) **Bulk moduli and high-pressure phases of the uranium rocksalt structure compounds. Pt. 1. The monochalcogenides.** Gerward, L.; Staun Olsen, J.; Benedict, U.; Dabos, S.; Vogt, O. Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements; Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik. 1989. 38p. Available from Copenhagen Univ. (Denmark). H.C. Oersted Inst.

The high-pressure crystal structures of the compounds UX, where X = S, Se and Te, have been studied using X-ray diffraction in the pressure range up to about 60 GPa. A rhombohedral distortion is observed for US above 10 GPa. USe and UTe transform into the CsCl structure at about 20 GPa and 9 GPa, respectively. The latter transformations show a considerable hysteresis when releasing the pressure. The scaling behaviour of the bulk modulus has been studied. It is shown that a log-log plot of the bulk modulus versus specific volume for the cubic phases gives a straight line with a slope near -2.

31327 (KU-HCOE-FL2-R–89-2) **Bulk moduli and high pressure phases of the uranium rocksalt structure compounds. Pt. 2. The monopnictides.** Staun Olsen, J.; Gerward, L.; Benedict, U.; Dabos, S.; Itie, J.P.; Vogt, O. Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements; Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik. 1989. 36p. Available from Copenhagen Univ. (Denmark). H.C. Oersted Inst.

The high-pressure crystal structures of the compounds UX, where X = N, P, As and Sb, have been studied using X-ray diffraction in the pressure range up to about 60 GPa. Rhombohedral distortions are observed for UN and UP above 29 GPA and 10 GPa, respectively. In UP a further transformation to an orthorhombic phase occurs at 28 GPa. UAs and USb transform to the CsCl structure at 20 GPa and 9 GPa, respectively. The latter transformations show a considerable hysteresis when the pressure is released. The scaling behaviour of the bulk modulus has been studied. It is confirmed that a log-log plot of bulk modulus versus specific volume for the cubic phases gives a straight line with a slope near -5/3.

31328 (KU-HCOE-FL2-R–89-3) **Bulk moduli and high-pressure phases of ThX compounds. Pt. 1. The thorium monopnictides.** Gerward, L.; Staun Olsen, J.; Benedict, U.; Dabos, S.; Luo, H.; Itie, J.P.; Vogt, O. Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements; Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer

Festkoerperphysik. 1989. 14p. Available from Copenhagen Univ. (Denmark). H.C. Oersted Inst.

The high-pressure crystal structures of the members of the ThX series, where X = N, P, As and Sb, have been studied using synchrotron X-ray diffraction in the pressure range up to about 60 GPa. ThN is structurally stable in the whole pressure range investigated. ThP, ThAs and ThSb transform into the CsCl structure at 47 GPa, 18 GPa and 9 GPa, respectively. The transformations have a considerable hysteresis when releasing pressure. A log-log plot of bulk modulus versus specific volume gives a straight line for ThP, ThAs and ThSb, the slope being near -2. The bulk modulus of ThN does not fit into this scaling behaviour.

31329 (KU-HCOE-FL2-R–89-4) **Bulk moduli and high pressure phases of ThX compounds. Pt. 2. The thorium monochalcogenides.** Staun Olsen, J.; Gerward, L.; Benedict, U.; Luo, H.; Vogt, O. Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements; Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik. 1989. 21p. Available from Copenhagen Univ. (Denmark). H.C. Oersted Inst.

The high-pressure crystal structures of the members of the ThX series, where X = S, Se and Te, have been studied using synchrotron X-ray diffraction in the pressure range up to about 60 GPa. A distorted fcc structure is observed for ThS above 20 GPa. These transforms to the CsCl structure at 15 GPa. has the CsCl structure already at atmospheric pressure and no further phase transition has been observed. A log-log plot of bulk modulus versus specific volume gives a straight line with slope -1.85.

31330 (KU-HCOE-FL2-R–89-6) **Observation of the l = 1/2 fractional quantum Hall plateau in AlGaAs/GaAs/AlGaAs selectively doped double heterostructures.** Lindelof, P.E.; Bruus, H.; Taboryski, R.; Soerensen, C.B. Copenhagen Univ. (Denmark). H.C. Oersted Inst. 1989. 28p. Order Number DE89775039/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

An inverted and a normal GaAs/AlGaAs interface grown back to back in a socalled selectively doped double heterostructure (SD DH) has been studied in magnetic fields up to 12 tesla and at temperatures down to 0.3 K. The longitudinal resistance goes to zero at minima of the Shubnikov-de Haas oscillations. The Hall resistivity is found to exhibit the quantum Hall effect. By etching the surface of the double heterostructure wafer we create an unbalance in the density of electrons in the two parallel two-dimensional electronic sheets. Although we in this way create only a modest change in the electron densities, we observe a significant change in the Shubnikov-de Haas oscillations, which can be interpreted as a beat between the oscillations of two electron layers with different densities. At the same time we observe a significant variation of the width of the quantum Hall steps. The most astonishing feature of our results is a clear quantum Hall plateou at 1/2 filling in each of the two parallel layers observed at temperatures below 1 K at a magnetic field above 10 T. Weak localization was also studied and such experiments are consistent with two parallel and independent two-dimensional electronic layers.

31331 (LA-UR–89-956) **Oxidation of MoS_2 by thermal and hyperthermal atomic oxygen.** Cross, J.B.; Martin, J.A.; Pope, L.E.; Koontz, S.L. Los Alamos National Lab., NM (USA); Sandia National Labs., Albuquerque, NM (USA). 1989. 7p. Sponsored by DOD;DOE/DP;NASA. DOE Contract W-7405-ENG-36;AC04-76DP00789. (CONF-890664–1: 3. international SAMPE electronics materials and processes conference, Los Angeles, California, USA, 19-22 Jun 1989;SAND–89-0106C). Order Number DE89009273/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The present study shows that at 1.5 eV O-atom translational energy SO_2 is generated and out gasses from a anydrous MoS_2 surface with a reactivity comparable that of kapton. The reaction of atomic oxygen with MoS_2 has little or no translational energy barrier, i.e., thermalally generated atomic oxygen reacts as readily as that having 1.5 eV of translational energy. It has also been shown that water present in the flowing afterglow apparatus used to study thermal O-atom reactivity formed sulfates on the MoS_2 surface and that the sulfate is most likely in the form of sulfuric acid. These results imply that water dumps or outgassing in low earth orbits have the potential of forming sulfuric acid covered surfaces on MoS_2 lubricants. 9 refs., 2 figs.

31332 (LA-UR–89-1722) **Barriers to the nucleation of methyl groups on the diamond (111) surface.** Valone, S.M. Los Alamos National Lab., NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890426–15: Spring meeting of the Materials Research Society, San Diego, California, USA, 24-28 Apr 1989). Order Number DE89013439/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Questions about the mechanism of diamond film growth by low-pressure, plasma-assisted chemical vapor deposition methods have persisted for some time now. As an attempt to explore one aspect of the problem, we examine the energetics of several adsorbed diamond (111) surfaces. The adsorbates are mixtures of methyl groups and hydrogen atoms. The model for these systems is the molecular orbital hamiltonian of Dewar and coworkers. From these calculations we find that H adsorbtion is preferred due both to bond energy and steric effects. Thus nucleation of a cluster of three or more methyl groups, as assumed in earlier work, is energetically very demanding. 6 refs., 3 figs.

31333 (LA-UR–89-1852) **High-frequency cavity applications and measurements of high-temperature superconductors.** Cooke, D.W.; Gray, E.R. Los Alamos National Lab., NM (USA). 1989. 17p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8905133–2: Workshop on high Tc superconductivity, Huntsville, Alabama, USA, 23-25 May 1989). Order Number DE89013467/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A potentially important application of high-temperature superconductors will be high-frequency accelerating cavities. Currently these materials are not competitive with Nb at liquid helium temperature or with Cu at room temperature. However, available data on high-quality single crystals suggest that the relatively poor rf properties (high surface resistance and low surface magnetic field) of bulk and film specimens are due to materials properties that can be eliminated by improved processing techniques. Recent progress in the fabrication of thin films, for example, demonstrates that this is indeed the case. 27 refs., 10 figs., 1 tab.

31334 (NEI-DK–173) **Quality demands and methods of control in the case of welded plastic-casing pipe joints. Part 1.** Ross, P.; Svanum, M. Jydsk Teknologisk Institut, Aarhus (Denmark). Mar 1983. 70p. (In Danish). Order Number DE89776153/JAW. Available from NTIS (US Sales Only), PC A04/MF A01;1.

EFP-82; EFP-83.

The aim of the literary study was to attain knowledge relevant to the production and utilization of pre-insulated district heating pipes coated with polyethylene. Methods of testing for longevity and quality in addition to an evaluation of welding processes were also studied. It was concluded that welders should be specially trained and follow clearly specified working procedures and that their equipment should be standardized. (AB).

31335 (SAND–88-3118) **Real gas equations of state for CHEMKIN.** Butler, P.B. Sandia National Labs., Albuquerque, NM (USA). Mar 1989. 32p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89012794/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

CHEMKIN is a chemical kinetics FORTRAN program developed to treat the gas-phase kinetics and associated thermodynamics for a set of user-defined chemical reactions. A key assumption made in CHEMKIN is that the gas behaves as a perfect gas, a restriction that results in noninterference of the individual species in a gas mixture (i.e., partial molal properties equal specific properties of pure component). Recently, the code was modified to account for real gas behavior according to the general limit method. The appropriate departure integrals for two real gas equations of state were calculated and included in a modified version of the code. The equations of state considered in this work were: a constant-covolume Noble-Abel function, and the Becker-Kistiakowsky-Wilson formulation. 9 refs., 2 figs., 7 tabs.

31336 (SAND–89-0842) **Micropyrolyzer design for infrared spectroscopy applications.** Blair, D.S.; Oborny, M.C. Sandia National Labs., Albuquerque, NM (USA). May 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE89013329/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Traditionally, pyrolysis combined with infrared, IR, detection of the decomposition products for the analysis of small (<1 mg) samples has been limited due to the size and geometry of commercially available pyrolysis chambers. To reduce the sample size requirements for pyrolysis-IR a system has been designed and built that allows various microgram sized polymer samples to be examined. The design incorporates a commercial pyrolysis system with a small chamber built from readily available parts. Minimal modifications of these components are required to build the system. The micropyrolyzer has been used to successfully identify various filled epoxy samples, such as three Epon 828 samples: 0.46 mg of alumina filled; 0.15 mg of mica filled; and 0.28 mg of glass microballoon, GMB, filled. 7 refs., 6 figs.

31337 (UCRL–21201) **Thermal-capillary model with axisymmetric fluid flow for analysis of Czochralski crystal growth of high Prandtl number materials: Final report.** Brown, R.A. Lawrence Livermore National Lab., CA (USA). 16 Sep 1987. 37p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012326/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The finite element analysis of conduction-dominated thermal-capillary models of the Czochralski crystal growth process developed by Derby and Brown was expanded to include analysis of axisymmetric flow in the melt caused by crystal and crucible rotation, and buoyancy and surface-tension-differences caused by temperature gradients in the melt. The analysis uses a mixed finite element method to solve simultaneously for velocity and pressure in the melt, and the temperature field in the melt, crystal and crucible. Newton's method us with out-of-core matrix techniques are used to solve the system of algebraic equations that arise from a quasi-steady-state model of the CZ system, neglecting batchwise transients in the process. This report details the formulation of the numerical method and sample calculations that prove convergence of the numerical algorithm. The calculations reported here are for a model of silicon crystal growth, a material with a low Prandtl number melt. 28 refs., 8 figs., 5 tabs.

31338 (WIC–1988) **Viscosity effects in selected flux cored arc welding consumables.** Leewis, K. Welding Inst. of Canada, Oakville, ON (Canada). 1988. 63p. (MICROLOG–89-01730). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Flux cored arc welding appears extremely appropriate for the repair and fabrication of offshore structures. Rutile flux eored welding consumables are preferred by welders using that technique. In order to understand why they perform better than basic and acid fluxes, the melting points and viscosities of a selected set of model fluxes were measured at elevated temperatures. The large change in viscosity was confirmed with these melts and also located in previous literature. This previously unreported ten-fold jump in viscosity for rutile slags suggests that their preferred operation was due to the natural formation of precipitates on cooling and the resulting increases in viscosity and silicate cooling. 11 refs., 6 figs., 4 tabs.

31339 Recent developments in the methods and applications of reactive laser-direct-patterning techniques. Ehrlich, D.J. (Lincoln Lab., MIT, Lexington, MA (US)); Tsao, J.Y. v.v of Laser chemical processing of semiconductor devices. Extended abstracts. Houle, F.A.; Deutsch, T.F.; Osgood, R.M. Jr. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

The current trends in submicrometer-resolution patterning techniques, based on laser-controlled surface reactions, are discussed. Particularly emphasized are recently demonstrated methods for patterned in situ growth by laser photodeposition of chemically active monolayer films including experiments with photochemical deposition of optimized heterogeneous catalysts. Also discussed are early experiments with direct patterning via excimer-laser projection microchemistry as well as the motivations for the development of excimer projection as a lithographic or nonlithographic area processing technology. The first microelectronics applications of laser direct patterning have concentrated on direct-writing with focused UV and visible laser beams. The new capabilities of these real-time microfabrication methods will be illustrated with recent examples in the repair of photomasks for x-ray lithograhpy and the fabrication of surface-acoustic-wave devices. Further examples are given from current work in techniques for semicustom circuit prototyping, and interactive logic design on CMOS gate-array circuits in the fashion of an integrated-circuit breadboard.

31340 Laser-written metallization patterns for solar cell applications. Dutta, S. (Westinghouse R and D Center, Pittsburgh, PA (US)); McMullin, P.G.; Rai-Choudhury, P.; Gallagher, B.D. v.v of Laser chemical processing of semiconductor devices. Extended abstracts. Houle, F.A.; Deutsch, T.F.; Osgood, R.M. Jr. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

Solar cell metallization patterns are conventionally formed by screen printing and subsequent firing. This is a rapid, inexpensive technique, but results in poor resolution and high contact resistance. Much better resolution and contact resistances are achieved by photolithographic definition of evaporated metal. However, this is a relatively expensive process, involving additional steps. Laser-assisted metallization techniques are being investigated as a promising, maskless alternative to conventional photolithography. Laser-induced photolysis and pyrolysis of organometallic vapors and solutions, as well as laser-enhanced electroplating, have been studied. The advantages of laser-assisted metallization techniques for photovoltaic applications include fine-line resolution, reduction in processing complexity by direct-write techniques, and the possibility of in-situ sintering during laser writing.

31341 Chemically amplified laser direct-writing of aluminum. Tsao, J.Y. (Sandia National Labs., Albuquerque, NM (US)); Ehrlich, D.J. v.v of Laser chemical processing of semiconductor devices. Extended abstracts. Houle, F.A.; Deutsch, T.F.; Osgood, R.M. Jr. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

The intent of this presentation is to summarize experimental work on an example of the second type, in which the laser direct writing of patterned thin films of Al is chemically amplified by subsequent selective pryolytic chemical vapor deposition (CVD). The basic experimental result has been described previously. The sequence of events used to produce that result is as follows. A 257 2.-nm UV laser beam first photodeposited a – 5-nm-thick stripe onto a quartz substrate bathed in a saturated vapor of triisobutylaluminum (TIBA). Then, the UV-laser beam was switched off, and a CO/sub 2/laser beam was shuttered on. The CO/sub 2/-laser radiation is absorbed strongly by the quartz and acts only as a convenient, in situ, modestly localized heat source for thermal CVD. After a – 2-min exposure to the CO/sub 2/-laser beam, no CVD occurred on the bare quartz outside the UV-photodeposited stripe, as shown in Fig. 1(b). Where the CO/sub 2/-laser beam spot intersected the stripe, however, the stripe thickened to – 100 nm. The maximum growth thickness possible before background nucleation becomes significant was not studied in detail. However, non-photonucleated growth did not occur after more than 20 min., implying that with stable temperature control over 1 μm of deposit could be grown without background nucleation. Separate measurements have shown that photodeposition of several monolayers is sufficient to achieve selective CVD with TIBA.

31342 Fracture from an atomistic point of view. Baskes, M.I. (Sandia National Labs., Livermore, CA (US)); Daw, M.S. v.v of Computer simulation in materials science. Arsenault, R.J.; Beeler, J.R.; Esterling, D.M. American Society for Metals, Metals Park, OH (1988). (CONF-8610374–: ASM materials seminar on computer simulation in materials science, Lake Buena Vista, Florida, USA, 4-5 Oct 1986).

The requirements of atomistic fracture calculations are reviewed. Based on these requirements, it is concluded that the Embedded Atom Method (EAM) is ideally formulated to be applied to such atomistic calculations. The EAM is briefly reviewed with an emphasis placed on user application. Specific examples of brittle fracture, dislocation motion, and ductile fracture are presented.

31343 Plasma initiated laser etching and deposition of semiconductor materials. Hargis, P.J. Jr. (Sandia National Labs., Albuquerque, NM (US)); Gee, J.M. v.v of Laser chemical processing of semiconductor devices. Extended abstracts. Houle, F.A.; Deutsch, T.F.; Osgood, R.M. Jr. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

Plasma-initiated laser etching and deposition is a versatile materials processing technique in which a dc-glow discharge and a pulsed-ultraviolet excimer laser are both required in order for deposition or etching to occur on semiconductor substrates. The authors show that the results obtained to date using a silane glow discharge can be interpreted in terms of the interaction of the incident ultraviolet laser radiation with an amorphous adlayer deposited on the irradiated substrate. They discuss a number of similarities we have observed between the plasma-initiated laser etching of inorganic insulators (thin-film CVD oxide, fused silica, amorphous sapphire, and pyrex) and the ablative removal of organic and inorganic thin films (positive and negative photoresist, tin oxide, and silicon nitride). Diagnostic results consisting of transmitted and reflected laser pulse shape measurements, as well as in situ spectroscopic measurements of the irradiated substrate, are discussed.

31344 Selective photochemical dry etching of III-V compound semiconductors. Ashby, C.I.H. (Sandia National Labs., Albuquerque, NM (US)). v.v of Laser chemical processing of semiconductor devices. Extended abstracts. Houle, F.A.; Deutsch, T.F.; Osgood, R.M. Jr. Materials Research Society, Pittsburgh, PA (1984). (CONF-841157–: Materials Research Society annual meeting, Boston, Massachusetts, USA, 26-29 Nov 1984).

The authors have identified the first photochemical dry etching reaction for III-V compound semiconductors which exhibits spatial, dopant, and material selectivity. This reaction shows great promise for use in fabrication of devices of GaAs and other III-V compound semiconductors.

31345 Laser processing. McWilliams, B.M. (Lawrence Livermore National Lab., Livermore, CA (US)); Fu, C.Y.; Mitlitsky, F.; Weiner, K.H. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Laser processing offers a synergistic array of new fabrication technologies addressing the potential needs of the competitive cost-effective low-volume silicon factory of the future. The authors report progress related to doping, deposition, and etching, the fundamental keys to full IC processing. The process of gas immersion laser doping (GILD), described in detail elsewhere, uses a pulsed excimer laser to form very shallow doped regions in silicon. Because the overall junction depth of the GILD process is highly predictable; the laser doping method is well suited for the fabrication of base/emitter regions in bipolar transistors. Diodes have been successfully fabricated with ideality factors of 1 and very low reverse bias leakage. Both base and emitter are formed with the GILD process. Junction depth is limited by the penetration of the melt front in the silicon; thus no subsequent high-temperature annealing is required, and the base and emitter depths are independent of each other. This allows simpler fabrication of base regions narrower than 1000 A. The GILD process is being used to fabricate narrowbase bipolar transistors.

31346 Fabrication of isotopic heterostructures and epitaxial thin films by ion beam deposition. Appleton, B.R. (Solid State Div., Oak Ridge National Lab., Oak Ridge, TN (US)); Zuhr, R.A.; Noggle, T.S.; Herbots, N.; Pennycook, S.J. v.v of Proceedings of the 1987 Electrochemical Society spring meeting: Extended abstracts. Volume 87-1. The Electrochemical Society, Pennington, NJ (1987). (CONF-870560–: 171. Electrochemical Society meeting, Philadelphia, Pennsylvania, USA, 10-15 May 1987).

A research ion implantation accelerator with mass and energy analysis and a neutral particle trap is used to produce isotopically pure ion beams. These ions are transported into an ultrahigh vacuum analysis chamber, decelerated to energies from 10-1000 eV, and deposited directly onto cleaned single-crystalline substrates of Si or Ge. This technique, called ion beam deposition (IBD), is capable of producing a wide variety of isotopic thin films and heterostructures and of fabricating epitaxial thin crystals at low temperatures. This paper concentrates on the use of IBD as a technique for fabricating artificially structured materials with emphasis on semiconducting structures. The techniques of ion scattering/channeling and cross-sectional transmission electron microscopy are utilized to characterize the deposited films.

31347 Molecular beam studies of silicon etching by F/sub 2/. Olander, D.R. (Lawrence Livermore National Lab., Livermore, CA (US)); Balooch, M.; Siekhaus, W.J. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

The reaction of F/sub 2/with Si (100) is studied by modulated molecular beam-mass spectrometry. The incident F/sub 2/beam is generated by effusion from a nickel source tube. A rotating toothed disk modulates the molecular beam at frequencies from 10 to 1000 Hz. The Si target is heated from 300 to 1200 K by radiation from a hot filament. The scattered reactant and volatile reaction products are detected by two quadrupole mass spectrometers with line-of-sight view of the reaction spot on the crystal surface. The mass spectrometer close to the target serves for surface reaction kinetics studies while the other helps determine the translational temperatures of the products. The apparent reaction probability, $\simeq$ (the ratio of the product and reactant fluxes), and the phase lag, phi, which is the difference between the product and the reactant phase angles, are obtained from information provided by the lock-in amplifier. These quantities can also be calculated from the theoretical models of the surface processes, and so provides the means of testing potential mechanisms against the data.

31348 A statistical approach for characterizing chemical durability within a waste glass compositional region. Piepel, G.F. (Pacific Northwest Lab., Richland, WA (US)); Mellinger, G.B.; Reimus, M.A.H. *Nuclear and Chemical Waste Management (USA)*, 9(1): 3-12 (1989).

In order to qualify nuclear waste forms for disposal in geological repositories, waste glass producers must adequately describe the properties of the glass. One of the most important of these properties is chemical durability (resistance to leaching). An approach for characterizing the chemical durability of a producer's waste glass form must take into account that the composition of the glass will vary during production. Thus, leach testing performed as part of the characterization effort must investigate the range of glasses that are likely to be produced. Also, the approach must account for the fact that only a limited number of compositional variations can be tested and that the leach test results will be subject to uncertainty. A statistical approach that satisfies these goals is presented. The statistical approach for characterizing the chemical durability of waste glasses in a specified compositional region involves the following steps: defining the compositional region of anticipated production glasses, selecting a test matrix of compositions via computer-aided experimental design techniques, leach testing, empirical modeling of the leach test results, investigating glass component effects, and using statistical confidence statements to describe chemical durability over the compositional region. These steps are illustrated using the results of work performed at Pacific Northwest Laboratory for West Valley Nuclear Services.

31349 Crystalline to amorphous transformation in GaAs during Kr ion bombardment: A study of elastic behavior. Sharma, R. P. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439(US)); Bhadra, R.; Rehn, L. E.; Baldo, P. M.; Grimsditch, M. *Journal of Applied Physics (USA)*, 66(1): 152-155 (1 Jul 1989). DOE Contract W-31-109-ENG-38.

A marked softening in the shear elastic properties of GaAs following 1.5-MeVKr ion irradiation is observed. Ion channeling and Raman scattering are used tomonitor the accumulation of damage,

which for 1.5-MeV incident energy extends toa depth of ~8000 A. Both techniques show that the sample is amorphized by adose of 2×10^{14} ions/cm^2. Brillouin scattering reveals that a shearelastic modulus of this near-surface irradiated region decreases by 43% as thematerial transforms from crystalline to amorphous. The observed results arediscussed and compared with similar measurements on Si and intermetalliccompounds.

31350 A mechanism for selectivity loss during tungsten CVD. Creighton, J.R. (Sandia National Labs., Albuquerque, NM (US)). *Journal of the Electrochemical Society (USA),* 136(1): 271-275 (Jan 1989).

The authors have investigated possible mechanisms for the loss of selectivity (i.e., deposition on silicon dioxide) during tungsten CVD by reduction of tungsten hexafluoride and found strong evidence that selectivity loss is initiated by desorption of tungsten subfluorides formed by the reaction of WF/sub 6/with metallic tungsten surfaces. Adsorption and disproportionation of the tungsten subfluorides on the silicon dioxide surface produces a reactive state of tungsten that can lead directly to selectivity loss. The key feature of the experimental setup is the ability to independently heat a tungsten foil and a nearby oxide-covered silicon sample in the presence of tungsten hexafluoride. With the tungsten foil at 600^{0}C and the SiO/sub 2//Si sample at –30^{0}C under a WF/sub 6/ambient, a tungsten subfluoride was found to deposit on the SiO/sub 2/surface. Auger electron spectroscopy was used to measure a F/W ratio of 3.7 ± 0.5. Heating this tungsten subfluoride overlayer resulted in disporportionation to yield gas-phase WF/sub 6/and metallic tungsten which remained on the surface. With the tungsten foil at 600^{0}C and the SiO/sub 2//Si sample at 300^{0}C in the presence of WF/sub 6/, metallic tungsten deposited directly on the SiO/sub 2/without stopping at the subfluoride adsorption step. The net effect of this tungsten subfluoride desorption-disproportionation mechanism is the transport of tungsten from tungsten surfaces to silicon dioxide surfaces as well as other regions in the deposition chamber. Extrapolated rates for this process are high enough to explain the magnitude of the selectivity loss seen at normal CVD temperatures.

31351 Defect generation in silicon dioxide from synchrotron radiation below 41 eV. Williams, C. K. (Microelectronics Center of North Carolina, P. O. Box 12889, Research Triangle Park, North Carolina 27709(US)); Reisman, A.; Bhattacharya, P. *Journal of Applied Physics (USA),* 66(1): 379-382 (1 Jul 1989).

Generation of fixed positive charge, neutral electron traps, and fixednegative charge in SiO_2 due to exposure to x radiation in the photon energyrange below 41 eV from a synchrotron source is reported. For constant incidentx-radiation exposure levels of 120 mJ/cm^2 with both monochromatic andbroadband radiation, the number of defects generated in the monitoring deviceswas at or below the detection limit of the equipment. This is in sharp contrastwith the results obtained at photon energies above 300 eV reported earlier [C.K. Williams, A. Reisman, P. K. Bhattacharya, and W. Ng, J. Appl. Phys.**64**, 1145 (1988)] in which a large number of each of the three defectsmentioned above were generated. The lack of damage indicates that the problemsassociated with x-ray-induced insulator damage due to x-ray lithography may besolved by tailoring the photon energy, provided suitable mask and photoresistmaterials can be developed.

31352 Interference effects probed by photoreflectance spectroscopy. Huang, D. (Coordinated Science Laboratory and Materials Research Laboratory, University of Illinois at Urbana-Champaign, 1101 W. Springfield Avenue, Urbana, Illinois 61801(US)); Mui, D.; Morkoc, H. *Journal of Applied Physics (USA),* 66(1): 358-361 (1 Jul 1989). DOE Contract AC02-76ER01198.

We report on oscillations in the photoreflectance (PR) spectra in the energyrange below the band gap of GaAs on samples containing GaAs/AlGaAs quantum wellsand the other multilayers grown on Si-doped GaAs substrates. The PR spectra withthe quantum well chemically removed continue to show these oscillations,indicating that they are not related to the quantum well. These oscillations,which are probed by the modulation technique, are attributed to the interferenceeffect of two light beams reflected from different interfaces of the sample.These spectra are calculated and good agreement with experimental data isobtained. We find that the interference effect distorts the line shape of the PRfeatures associated with quantum wells and band edge of bulk semiconductors,especially at the low-energy side. Therefore, this effect must be taken intoaccount during analysis. As an application, this interference effect can be usedto accurately measure epilayer thicknesses.

31353 A radially perfused cell for measuring diffusion in compacted, highly sorbing media. Jahnke, F.M. (Manufacturing Research and Engineering Organization, Research Labs., Eastman Kodak Co., Rochester, NY (US)); Radke, C.J. *Industrial and Engineering Chemistry Research (USA),* 28(3): 347-355 (Mar 1989).

A unique radially perfused cell designed specifically to measure the transient diffusion of species in compacted, highly adsorbing and swelling porous media is described in this paper. The perfused cell exhibits extremely high mass-transfer coefficients while resisting large swelling pressure. It also allows a simultaneous determination of the effective diffusion and sorption retardation coefficients of species from a single experiment. The concentration boundary layer resulting from the radial flow configuration is sufficiently uniform that one-dimensional, axial diffusion is studied in the sample medium. Over the range of Peclet numbers studied, from 10/sup 3/to 3 x 10/sup 5/, overall Nusselt numbers range from 70 to 550, in excellent agreement with a theoretical convective dispersion prediction containing no adjustable parameters. Use of the cell is illustrated by an experiment in which cesium chloride diffuses into a moderately compacted sodium montmorillonite clay gel. They find that surface diffusion controls the migration of cesium in these clays.

31354 Topological and bonding defects in vitreous silica surfaces. Feuston, B. P. (Department of Ceramics, Rutgers University, Piscataway, New Jersey 08855(US)); Garofalini, S. H. *Journal of Chemical Physics (USA),* 91(1): 564-570 (1 Jul 1989).

A model structure for an annealed silica surface was obtained through themolecular dynamics simulation technique employing three-body interactionpotentials. Nonbridging oxygen and edge-sharing tetrahedra were found to form onthe oxygen-terminated surface with three-coordinated silicon, three-coordinatedoxygen, and three-membered rings just below the outermost atoms. Four-memberedrings were also created in relatively large concentrations during the surfacerelaxation. When considering the effect of removing periodic boundary conditionsalong the z direction, the concentration of larger rings, relative to thebulk, remained unchanged throughout the ~11 A simulated surface region. Astrong physical association between three-membered rings and three-coordinatedoxygen was found which may account for the D_2 defect peak observed inRaman scattering.

31355 Observation of phase transitions on the (111) and (100) surfaces of Si near 1000 K with He atom diffraction. Ha, J. S. (Department of Chemistry, Brown University, Providence, Rhode Island 02912(US)); Greene, E. F. *Journal of Chemical Physics (USA),* 91(1): 571-576 (1 Jul 1989).

He diffraction has been used to study structural phase transitions on the(111) and (100) surfaces of Si. The seventh-order peaks of the Si(111)-7×7reconstructed surface observed at room temperature first decreased withincreasing temperature and then disappeared near 1140 K. A sharp decrease in thespecular intensity and a sharp increase in the diffuse scattering were alsoobserved near 1140 K, but there was no broadening of the peaks as thetemperature increased. We confirm earlier evidence that the 7×7 to "1×1"phase transition at 1138±7 K on the Si(111) surface is an order–disorderone. The He scattering from the Si(100)-2×1 reconstructed surface stable atroom temperature was also measured as the temperature increased. There was achange in the Debye–Waller slope at 930±20 K which is evidence for thestructural phase transition expected from theoretical calculations and deducedfrom earlier experiments in this laboratory on the desorption kinetics of alkaliatoms from this surface. These experiments show that He diffraction offers auseful way of studying phase transitions on semiconductor surfaces.

31356 Near-infrared surface-enhanced Raman spectroscopy. Part I: Copper and gold electrodes. Angel, S. M. (Environmental Sciences Division, Lawrence Livermore National Laboratory, Livermore, California 94550 (S.M.A., L.F.K.)); Katz, L. F.; Archibald, D. D.; Lin, L. T.; Honigs, D. E. *Applied Spectroscopy (USA),* 42(8): 1327-1331 (Nov 1988). DOE Contract W-7405-ENG-48.

Surface-enhanced Raman spectra of pyridine on copper and gold electrodesin the near-infrared were obtained with a Fourier transform Ramanspectrometer. Surface-enhanced Raman spectra were observed forpyridine adsorbed on copper and gold electrodes while a Nd:YAG laser(1.064 μm) was used for excitation. Good-quality spectra were recordedfor 0.08 mM pyridine on a copper electrode with a single oxidation-reductioncycle, whereas for a gold electrode, several ORCs were necessary.A very intense low-energy Raman band was observed on bothmetals at positive potentials, which may be due to a metal-oxidevibrational mode.

31357 Carrier lifetimes in ion-damaged GaAs. Johnson, M. B. (California Institute of Technology, Pasadena, California 91125(US)); McGill, T. C.; Paulter, N. G. *Applied Physics Letters (USA),* 54(24): 2424-2426 (12 Jun 1989).

Photoluminescence excitation correlation spectroscopy has been used tomeasure the dependence of carrier lifetime on the H^+ ion implantation dose inGaAs. For doses greater than 1×10^{12} cm^{-2} the carrier lifetime isinversely proportional to the ion dose. The minimum lifetime measured was0.6 ± 0.2 ps for a dose of 1×10^{14} cm^{-2}. Most important, there is nosign of saturation of carrier lifetime with ion dose down to this lifetime, thusstill shorter lifetimes should be achievable with increased ion dose.

31358 Electronic structure of [110] Si-Ge thin-layer superlattices. Froyen, S. (Solar Energy Research Institute, Golden, Colorado 80401(US)); Wood, D. M.; Zunger, A. *Applied Physics Letters (USA),* 54(24): 2435-2437 (12 Jun 1989). DOE Contract AC02-77CH00178.

First-principles electronic structure calculations forSi_nGe_n superlattices (for n=4, 6, and 8) grownepitaxially on a (110) Si substrate reveal a nearly direct band gap (to within$\approx$0.04 eV for n=4) despite the pronounced indirectness of its constituents.This is unlike superlattices grown in the [001] direction which are indirectwhen grown on Si and quasi-direct only on substrates with larger latticeconstants, e.g., Ge. Transition dipole matrix elements for the lowest energydirect transition vanish for all repeat periods n but are finite for severalother new low-energy transitions.

31359 Thin-film deposition by a new laser ablation and plasma hybrid technique. Krishnaswamy, J. (Materials Science and Engineering Department, North Carolina State University, Raleigh, North Carolina 27695(US)); Rengan, A.; Narayan, J.; Vedam, K.; McHargue, C. J. *Applied Physics Letters (USA),* 54(24): 2455-2457 (12 Jun 1989).

We have developed a new laser ablation and plasma hybrid technique fordepositing thin diamond-like carbon (DLC) films on Si(100) substrates atroom temperature and at 110 °C with improved optical and mechanicalproperties. The technique involves coupling of laser energy (λ=0.308 μm,pulse duration=40 ns, and power 125 MW/cm^2) to a graphite target andsuperimposing capacitively stored energy (2–3 J at 3 kV) to the laser ablatedspot. The laser- and plasma-deposited diamond-like carbon films were analyzed byspectroscopic ellipsometry and microhardness measurements. These films showedconsiderable improvements in both uniformity and homogeneity. Optical propertiesand hardness of the films deposited by this technique closely match the DLCfilms. We discuss possible causes of improvements in the above properties ofthese films.

31360 Growth of alkali halides from molecular beams: Global growth characteristics. Yang, M. H. (Department of Physics and the Materials Research Laboratory, University of Illinois at Urbana-Champaign, 1110 West Green Street, Urbana, Illinois 61801(US)); Flynn, C. P. *Physical Review Letters (USA),* 62(21): 2476-2479 (22 May 1989). DOE Contract AC02-76ER01198.

Alkali-halide single crystals are shown to grow from molecular beams under conditions systematically different from those for metals and elemental semiconductors, for reasons related to ionic bonding. Heteroepitaxy, and the occurrence of epitaxially stabilized new alkali-halide alloys and compounds, are discussed.

31361 Interferometric measurement of the pressure-enhanced crystallization rate of amorphous Si. Lu, G. Q. (Division of Applied Sciences, Harvard University, Cambridge, Massachusetts 02138(US)); Nygren, E.; Aziz, M. J.; Turnbull, D.; White, C. W. *Applied Physics Letters (USA),* 54(25): 2583-2585 (19 Jun 1989). DOE Contract AC05-84OR21400.

We have measured the pressure dependence of the solid phase epitaxial growthrate of self-implanted Si (100) by using the *in situ*time-resolved interferometric technique in a high-temperature and high-pressurediamond anvil cell. With fluid argon as the pressure transmission medium, aclean and perfectly hydrostatic pressure environment is achieved around thesample. The external heating geometry employed provides a uniform temperatureacross the sample. At temperatures in the range of 530–550 °C and pressuresup to 3.2 GPa (32 kbar), the growth rate is enhanced by up to a factor of 5 overthat at 1 atmosphere pressure. The results are characterized by a negativeactivation volume of approximately -3.3 cm^3/mole (-28% of the atomic volume).These results show a significantly weaker pressure dependence than does theprevious work of Nygren *et al.* [Appl. Phys. Lett. **47**,232 (1985)], who found an activation volume of -8.7 cm^3/mole. The implicationof this measurement for the nature of the defects responsible for crystal growthis discussed.

31362 *FTHETA* point exponents of polymers in d=2. Meirovitch, H. (Supercomputer Computations Research Institute, Florida State University, Tallahassee, Florida 32306-4052(US)); Lim, H. A. *Physical Review Letters (USA),* 62(22): 2640-2640 (29 May 1989).

A Comment on the Letter by B. Duplantier, and H. Saleur, Phys. Rev. Lett. 59, 539 (1987).

31363 X-ray determination of the modulation potential in a stage-2 potassium-graphite intercalation compound. Kan, X. B. (Department of Physics, University of Houston, Houston, Texas 77204-5504(US)); Robertson, J. L.; Moss, S. C.; Ohshima, K.; Sparks, C. J. *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 10627-10632 (15 May 1989).

By use of both synchrotron and conventional x-ray sources, the *HK.L* Bragg peaks have been measured at room temperature on a single crystal of graphite, intercalated with potassium to stage 2. For these reflections there is a contribution of the two-dimensional alkali metal liquid due to the modulation induced by the host graphite lattice. Using the theory of Reiter and Moss, we have extracted the modulation potential by fitting the integrated intensities for the $H-K=3m$ reflections and the intensity profiles along L for those reflections where $H-K=3m\pm1$. The potential is similar to that derived for Rb in graphite but with enhanced local minima at the carbon atoms. The stacking faults in this crystal are found to occur at random.

31364 Photoluminescence in (Ga,In)P at high pressure. Patel, D. (Department of Physics, Colorado State University, Fort Collins, Colorado 80523(US)); Chen, J.; Kurtz, S. R.; Olson, J. M.; Quigley, J. H.; Hafich, M. J.; Robinson, G. Y. *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 10978-10981 (15 May 1989).

Room-temperature photoluminescence measurements have been carried out at high pressure on (Ga,In)P layers grown by two different methods. The pressure dependence of the direct energy-band gap was fitted with a second-order function. Evidence of the direct-indirect band crossing has been observed from the reduction in the photoluminescence efficiency at about 2.8 GPa pressure.

31365 Breathing-mode lattice relaxation accompanying emission and capture by deep electronic levels in silicon. Samara, G. A. (Sandia National Laboratories, Albuquerque, New Mexico 87185(US)). *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 11001-11010 (15 May 1989). DOE Contract AC04-76DP00789.

The breathing-mode (volume) lattice relaxations associated with carrier emission and capture by a variety of deep electronic levels in silicon are evaluated from high-pressure measurements of the emission rates and capture cross sections. Included are (1) the vacancylike acceptor levels associated with the oxygen-vacancy pair (or *A* center) and the gold, platinum, and palladium impurities, (2) the chalcogenide donors in their singly and doubly charged states, (3) a number of 3*d* transition-metal donors, and (4) the phosphorus-vacancy pair (or *E* center) acceptor. The signs and magnitudes (which range from $\sim$0 to 5 A^3/emitted-carrier) of these relaxations

are discussed in terms of models for the impurities and defects responsible for the associated levels. The results on the chalcogenides are compared with recent theoretical results. The experimental method used appears to be the only viable experimental method for determining these relaxations which are a direct manifestation of the effective electron-phonon coupling at deep levels and which are important to the understanding of many of the properties of deep levels.

31366 Diffusion of tritons, deuterons, and protons in $LiNbO_3$ crystals. Gonzalez, R. (Departamento de Fisica del Estado Solido, Facultad de Ciencias Fisicas, Universidad Complutense de Madrid, E-28040 Madrid, Spain(ES)); Ballesteros, C.; Chen, Y.; Abraham, M. M. *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 11085-11092 (15 May 1989).

Infrared absorption of OT^-, OD^-, and OH^- ions is used to monitor the presence of the three hydrogenic isotopes in $LiNbO_3$ single crystals. Tritium ions were produced by transmutation of the $_3^6Li$ nucleus via a ($_0^1n_{1,2}{}^4He$) reaction using thermal neutrons. OD^- ions were added to the crystal by subsequent heat treatments in D_2O vapor. There exist several configurations for each isotope, and each configuration is common to all three isotopes. Following isochronal heat treatments, the corresponding infrared bands for the three isotopes exhibit similar decay and growth behavior. Diffusion coefficients for all three hydrogenic species have been obtained. Between 900 and 975 K the diffusion coefficients were of the order of 10^{-7} cm^2/s.

31367 Crystal-field splitting of core excitons in ionic crystals. Sette, F. (AT&T Bell Laboratories, Murray Hill, New Jersey 07974(US)); Sinkovic, B.; Ma, Y. J.; Chen, C. T. *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 11125-11130 (15 May 1989).

High-resolution and temperature-dependent photoabsorption measurements at the potassium $L_{2,3}$ edges in KF, KCl, KBr, KI, and $KMnF_3$ are used to study the crystal-field splitting of potassium $2p^{-1}3d$ core excitons. The direct observation of two split states allows one to explore the dependence of the crystal-field potential and of the 3*d* orbital spatial extent on thermal expansion, atomic vibrational motion, and the halide atom. Using the simple 10*Dq* theoretical model, we measured the size of the 3*d* orbitals and found that they collapse toward the potassium 2*p* core hole. The dynamical character of this process is demonstrated by the correlation between the core-exciton size and the optical dielectric constant.

31368 4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides. Cox, L. E. (Materials Science and Technology Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Farr, J. D. *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 11142-11145 (15 May 1989).

With our measurements of the 4*f* binding energies of NpF_4 and PuF_4, values for all the light-actinide dioxides and tetrafluorides (Th–Pu, except Pa) are available. In spite of the fact that the electronegativities of these elements are nearly constant, the chemical shifts for each series show a regular increase, relative to the metals. Using the results of previously reported band-structure and molecular-orbital calculations, we show that the shifts result from increasing differences in 5*f* occupation and, to a lesser extent, increases in the 5*f*–core-level Coulombic interaction. Recently reported L_3 x-ray-absorption and renormalized-atom calculations are employed to assess the importance of final-state screening energies in both the metals and the insulating compounds.

31369 Rotational states of H_2, HD, and D_2 on graphite. Novaco, A. D. (Brookhaven National Laboratory, Upton, New York 11973(US)); Wroblewski, J. P. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11364-11371 (1 Jun 1989). DOE Contract AC02-76CH00016.

The rotational states of H_2, HD, and D_2 adsorbed on graphite in the $\sqrt{3} \times \sqrt{3}$ *R*30° commensurate phase, were calculated using a product wave function consisting of a rotational part, itself a product of single-molecule rotational wave functions, multiplied by a spatial part which describes the motion of the molecular center of mass. The single-molecule rotational term is written as an expansion in free-rotor basis functions. The spatial part is given by a self-consistent-phonon wave function determined in a previous calculation. The rotational ground state for each species is found to be a nearly pure J=0 state, and the lowest group of excited states, which are essentially J=1 states, are split with an energy separation of about 2.5–2.7 meV. These excited states are separated from the ground state by an average energy which is given approximately by $BJ(J+1)$, where B is the rotational constant of the molecule. Thus the rotational states of hydrogen molecules adsorbed on graphite are, to a good approximation, slightly hindered three-dimensional rotor states.

31370 X-ray diffraction and equation of state of solid neon to 110 GPa. Hemley, R. J. (Geophysical Laboratory, Carnegie Institution of Washington, Washington, D.C. 20008(US)); Zha, C. S.; Jephcoat, A. P.; Mao, H. K.; Finger, L. W.; Cox, D. E. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11820-11827 (1 Jun 1989). DOE Contract AC02-76CH00016.

Solid neon was compressed under static conditions at 300 K to pressures in the 100 GPa (megabar) range using diamond-anvil cell techniques. The crystal structure and *P-V* equation of state were determined by energy-dispersive x-ray diffraction with microcollimated synchrotron radiation. Pressures were determined from ruby fluorescence spectra and from x-ray diffraction of tungsten powder contained within the sample. Solid neon remains an insulator with the fcc structure to the maximum pressure of 110 GPa at 300 K, where the compression V/V_0 is 0.28. The 300-K *P-V* isotherm measured at high pressure is in excellent agreement with the results of electronic structure calculations but is incorrectly described by pure pair potentials recently developed for neon. These results indicate that there is a significant softening of the material by many-body interactions at high pressures. Finally, the measurements of ruby fluorescence and tungsten x-ray diffraction in the neon medium obtained in this study provide an extension of the quasihydrostatic ruby pressure scale above 100 GPa.

31371 Theory of the spin liquid state of the Heisenberg antiferromagnet. Kalmeyer, V. (Department of Physics, Stanford University, Stanford, California 94305(US)); Laughlin, R. B. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11879-11899 (1 Jun 1989).

We propose that the disordered state of a two-dimensional spin-1/2 Heisenberg antiferromagnet is physically equivalent to the incompressible liquid state of the fractional quantum Hall system. The fractional quantum Hall state for bosons is shown to be an exact spin singlet and to possess a low variational energy for the near-neighbor Heisenberg model on a triangular lattice. Variational wave functions for neutral spin-1/2 excitations are constructed and shown to form an exact spin doublet. Variational energies of these states are calculated, and their spin density profiles are determined. We find that a localized spin-1/2 quaisparticle has a size comparable to a lattice bond length and an excitation energy Δ=1.3*J*. The energy-momentum dispersion of quasiparticles and spin-1 collective modes, obtained variationally, supports the hypothesis that the spin liquid state has a finite energy gap. The 1/2 fractional statistics exhibited by the quasiparticle excitations is explicitly demonstrated.

31372 Excitonic states in pure and impurity-doped magnesium oxide. Pandey, R. (Department of Physics, Michigan Technological University, Houghton, Michigan 49931(US)); Zuo, J.; Kunz, A. B. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12565-12567 (15 Jun 1989).

Excitonic states in pure and anion-impurity-doped MgO are investigated inseveral well-defined models using unrestricted Hartree-Fock(UHF)/icecap (ionic crystal with electronic cluster,automatic program) simulation procedures. The calculated excitation energies inpure MgO are in excellent agreement with the experiment. The results forS^{2-}- or Se^{2-}-doped MgO show quite conclusivelythat the lattice response needs to be consistently incorporated with the defectelectronic structure.

31373 Pressure dependence of deep electronic levels in semiconductors: Phosphorus-vacancy pair (or Si *E* center) and divacancy in silicon. Samara, G. A. (Sandia National Laboratories, Albuquerque, New Mexico 87185(US)). *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12764-12774 (15 Jun 1989). DOE Contract AC04-76DP00789.

The effects of hydrostatic pressure on the electron thermal emission ratesand capture cross sections of three deep electronic levels in phosphorus-dopedsilicon were investigated. Included were the $E_c-0.44$ eVacceptor associated with the phosphorus-vacancy pair defect (or Si *E*center), the $E_c-0.23$ eV acceptor associated with the $2-/-$ charge state of the divacancy, and a level of uncertain origin at$E_c-0.40$ eV. The results allow determination of the shiftof the energies of these levels with pressure and of the breathing-mode latticerelaxations which accompany electron emission and capture by these levels. Thisis the first determination of these properties. For the phosphorus-vacancyacceptor, pressure shifts the level deeper into the band gap, and an outward(inward) volume relaxation accompanies electron emission (capture). Theseresults can be qualitatively understood in terms of the accepted model for thisdefect and the bondinglike nature of its level. Qualitatively similar resultsare obtained for the $E_c-0.40$ eV level, but oppositeeffects are seen for the divacancy level. Specifically, with pressure, thislatter level moves higher in the band gap, and the lattice relaxes inward(outward) on electron emission (capture). These results can also be understoodin terms of the accepted model for the defect and the antibondinglike nature ofits level.

31374 Surface phonon modes of the RbBr(001) crystal surface by inelastic He-atom scattering. Chern, G. (Department of Physics, Florida State University, Tallahassee, Florida 32306-3016(US)); Skofronick, J. G.; Brug, W. P.; Safron, S. A. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12838-12844 (15 Jun 1989).

Inelastic He-atom scattering ($k_i \approx 7 A^{-1}$) was used to measure the dynamics of the RbBr(001) crystal surface ($T_s \approx 115$ K). Time-of-flight spectra taken in two high-symmetry directions, ⟨100⟩ and⟨110⟩, were analyzed to give the surface dispersion curves for the entire surface Brillouin zones $\bar{\Gamma}\,\bar{X}$ and $\bar{\Gamma}\,\bar{M}$. The Rayleigh mode and its geometric "folded," optical surface resonance (expected from the quasimonatomic behavior due to the nearly equal masses of the Rb^+ and Br^- ions) were observed; the data also suggest the existence of another optical surface feature in the optical band. Although calculations had suggested that this crystal should have importantsurface relaxation effects, the main one being a surface-localized opticalbranch lying above the optical band, no evidence of this was seen. Moreover,the calculated surface dispersion curves for the unrelaxed surface appear tofit the measurements slightly better than those for the relaxed surface,although neither predicts the optical resonance mentioned above. Finally, theseobserved differences provide guidance on the use of the shell model fordescribing the physics of ionic insulator crystals.

31375 Polarons in acetanilide. Scott, A. C. (Department of Mathematics, The University of Arizona, Tucson, Arizona 85721(US)); Bigio, I. J.; Johnston, C. T. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12883-12887 (15 Jun 1989).

The best available data are presented of the integrated intensity of the1650-cm^{-1} band in crystalline acetanilide as a function oftemperature. A concise theory of polaron states is presented and used tointerpret the data.

31376 Observation of graphitic and amorphous structures on the surface of hard carbon films by scanning tunneling microscopy. Marchon, B. (Center for Advanced Materials, Lawrence Berkeley Laboratory, Berkeley, California 94720(US)); Salmeron, M.; Siekhaus, W. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12907-12910 (15 Jun 1989).

The atomic structure of the surface of amorphous hard carbon films, prepared by dc magnetron sputtering, has been studied by scanning tunneling microscopy. Small graphitic domains of ~15 A have been observed. In many disordered areas, five-membered carbon rings were often detected. Other ordered domains are observed which could be interpreted as due to small diamondlike clusters.

31377 Electronic and structural properties of a discommensurate monolayer system: GaAs(110)-(1×1)Bi. McLean, A. B. (IBM Research Division, Thomas J. Watson Research Center, P.O. Box 218, Yorktown Heights, New York 10598(US)); Feenstra, R. M.; Taleb-Ibrahimi, A.; Ludeke, R. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12925-12928 (15 Jun 1989).

We report the structural and electronic properties of a new orderedBi(1×1) overlayer on cleaved GaAs(110) surfaces. Although somestructural similarities exist between the ordered Bi monolayer and that for Sb,our studies show the following novel features: a periodic one-dimensional arrayof misfit dislocations, which appear to generate acceptor states that "pin"the Fermi level on *n*-type GaAs, and Bi-derived valence and conductionbands that extend into the GaAs band gap and are separated by 0.7 eV.

31378 Electronic instabilities of the quasi-two-dimensional monophosphate tungsten bronze $P_4W_{12}O_{44}$. Wang, E. (Department of Chemistry, RutgersThe State University of New Jersey, New Brunswick, New Jersey 08903(US)); Greenblatt, M.; Rachidi, I. E.; Canadell, E.; Whangbo, M.; Vadlamannati, S. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12969-12972 (15 Jun 1989).

We report results of electrical resistivity, Hall effects, and magneticsusceptibility measurements on oriented single crystals of$P_4W_{12}O_{44}$, which suggest that$P_4W_{12}O_{44}$ has two resistivityanomalies arising from charge-density-wave instabilities. Tight-bindingelectronic-band-structure calculations on theW_6O_{22} slab of$P_4W_{12}O_{44}$ support the abovesuggestion.

31379 Bonding of Se and ZnSe to the Si(100) surface. Bringans, R. D. (Xerox Palo Alto Research Center, 3333 Coyote Hill Road, Palo Alto, California 94304(US)); Olmstead, M. A. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12985-12988 (15 Jun 1989).

The interfaces formed when films of Se and ZnSe are deposited on Si(100)substrates have been studied with photoemission core-level spectroscopy. For Sefilms deposited at room temperature and annealed, the presence of Si atoms withchemical shifts of δ, 2δ, 3δ, and 4δ whereδ is 0.53 ± 0.03 eV were found, suggesting theformation of $SiSe_2$. At higher annealing temperatures, the resultsare consistent with the presence of a submonolayer of Se atoms in bridge siteson the Si(100) surface. ZnSe films were deposited at room temperature and at300 °C on Si(100) and the primary bonding at the interface was found to bebetween Si and Se. Island formation occurred in the initial stages of growth atthe higher temperature.

31380 Thermal conductivity of deformed potassium chloride. Yang, I. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801(US)); Anderson, A. C. *Physical Review [Section] B: Condensed Matter (USA),* 39(18): 13498-13503 (15 Jun 1989). DOE Contract AC02-76ER01198.

The thermal conductivities of plastically deformed KCl crystals weremeasured in the temperature range 0.02–10 K. The measurements indicatethat thermal phonons are scattered strongly by dislocations. Heat-pulsemeasurements support this interpretation. The thermal conductivity of adeformed KCl sample is restored by γ irradiation, suggesting that thephonon-dislocation interaction in KCl is dynamic in nature. The experimentalresults are compared with numerical calculations assuming dynamic phononscattering from isolated, fluttering dislocations. There is reasonableagreement for small dislocation densities, but not for heavily deformedsamples.

31381 Low density microcellular carbon or catalytically impregnated carbon forms and process for their preparation. Hopper, R.W.; Pekala, R.W. To Dept. of Energy, Washington, DC. USA Patent 4,806,290. 21 Feb 1989. Filed date 29 Mar 1987. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

Machinable and structurally stable, low density microcellular carbon, and catalytically impregnated carbon, foams, and process for their preparation, are provided. Pulverized sodium chloride is classified to improve particle size uniformity, and the classified particles may be further mixed with a catalyst material. The particles are cold pressed into a compact having internal pores, and then sintered. The sintered compact is immersed and then submerged in a phenolic polymer solution to uniformly fill the pores of the compact with phenolic polymer. The compact is then heated to pyrolyze the phenolic polymer into carbon in the form of a foam. Then the sodium chloride of the compact is leached away with water, and the remaining product is freeze dried to provide the carbon, or catalytically impregnated carbon, foam.

40 CHEMISTRY

Refer also to citation(s) 30372, 30986, 30990

4001 Analytical and Separations Chemistry

Refer also to citation(s) 30297, 30312, 30427, 30532, 30533, 30565, 30653, 31242, 31271, 31276, 31283, 31356, 31488, 31489, 31490, 31492, 31493, 31494, 31553, 31805, 31806, 31883, 31925, 32210, 32796

31382 (AERE-R–12863) **Photofission assay of 500 litre drums of cemented intermediate level waste. Experimental measurements.** Findlay, D.J.S. UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div. Jan 1989. 30p. (QCTF–87-P14;ILWRP–87-P14;DOE-RW–88.110). Available from H.M. Stationery Office, London, price Pound 8.00.

Measurements are presented of neutrons photoproduced from natural uranium samples placed within 500 litre drums of cemented inactive Magnox swarf. The source of photons was 5-8 MeV bremsstrahlung from the Harwell electron linac HELIOS, and the neutrons were detected in a single lead-shielded /sup 10/BF/sub 3/ counter. The predictec assay sensitivity limit, based on counting statistics, for actinides within the drum is ~100 g (3 σ), and the response is uniform to within an overall factor 1.3 across a radius.

31383 (BARC–1437) **Simultaneous estimation of Pu and fission products by gamma spectrometry.** Achuthan, P.V.; Bhogale, R.G.; Ramanujam, A.; Iyer, M.R.; Sharma, D.N.; Raman, N. Bhabha Atomic Research Centre, Bombay (India). 1988. 11p. Order Number DE89613058/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A gamma spectrometric method is described for the simultaneous estimation of Pu and fission products using a 62cc intrinsic germanium detector coupled to a 4K MCA. The 120 KeV peak of /sup 239/Pu was employed for the assay of plutoniu m. The low energy 51 KeV photopeak of /sup 239/Pu was not employed due to the interfer ence of the germanium escape peak from /sup 241/Am gamma. A nonlinear exponential parame terised function was employed to relate the concentration of /sup 239/Pu and the counts obtained from 129 KeV photopeak after subtracting the compton and background. Standard solutions were used for computing the fitting parameters. For fission product analysis, an efficiency versus energy plot was generated using a fission product solution of known individual activities. This was then fitted in a quadratic equation and the fitting parameters were obtained. The inbuilt programme in 4K MCA was used to calculate the /sup 239/Pu and the fission products concentration from the respective fitting factors. The isotopic composition was fed externally to obtain the total plutonium concentration. This method was used for the analysis of Pu in the range of 0.5 to 5 g/1. The values when compared with those obtained with coulometric meth od show an agreement within $\pm$ 2.5 per cent in the above range. (author). 4 refs., 4 figs., 2 tables.

31384 (CEA-CONF–9415) **Use of various ionization modes for the study of molecules of biological interest.** Forest, E. CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI). 1987. 22p. (In French). (CONF-8710386–: Workshop on mass spectrometry, Marcoule, France, 22-23 Oct 1987). Order Number DE89760705/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

For the last ten years a revolutionary advance in mass spectrometry applied to molecules of biological interest occurred, chiefly concerning ionization with the emergence of many new modes allowing non volatile, polar or thermally labile sample analysis. Some examples of spectra obtained on high mass molecules such as vitamins, protein fragments, porphyrins (chlorophyll or hemoglobin active site), polysaccharides, are presented using some of the new modes.

31385 (IEN-DQUI-DIQUI–03/80) **Influences of the HNO/sub 3/initial concentration at aqueous phase and the temperature on zirconium extraction.** Azevedo, H.L.P. de. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). 1980. 13p. (In Portuguese). Order Number DE89613114/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Data related to influences of initial nitric acid concentration and temperature on zirconium extraction are obtained. The coefficient of zirconium distribution increases continuously wih initial HNO/sub 3/ concentration at aqueous phase. The temperature variation between 13 and 80/sup 0/C also showed continuous increase of the coefficient of zirconium distribution, except in the system with initial 1M HNO/sub 3/concentration, which registered minimum one in the range of 41-44/sup 0/C. (M.C.K.).

31386 (INIS-BR–1453) **Obtainment of sodium vanadate in sulfuric medium.** Martins, A.H.; Cassa, J.C.S. Associacao Brasileira de Metais, Sao Paulo, SP (Brazil). 1988. 16p. (In Portuguese). (CONF-8809333–: 13. national meeting on mineral treatment and hydrometallurgy, Sao Paulo, Brazil, 26-29 Sep 1988). Order Number DE89613115/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This paper presents the result of a some of the operational variables, in the precipitation of sodium vanadates in sulfuric medium at temperature of 60/sup 0/C, such as: initial pH of precipitation, solution aging, intensity of agitation, H/sub 2/SO/sub 4/concentration of titration solutions, cooling rate solution after neutralization and addition rate of neutralization solution.

31387 (INIS-BR–1483, pp. 91) **Analysis of elements produced in TCDDC system by mass spectrometry.** Martins, R. (Portugal); Guimaraes, L. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (In Portuguese). (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CHEMICAL REACTION YIELD/chemical composition; CHEMICAL REACTION YIELD/crystal structure; CHEMICAL REACTION YIELD/mass spectroscopy; CHEMICAL REACTION YIELD/mixtures; MIXTURES/chemical reaction yield; MIXTURES; DECOMPOSITION; GASES; HIGH-FREQUENCY DISCHARGES; METHANE; SILANES; X-RAY DIFFRACTION

31388 (INIS-BR–1487) **Potential of heavy minerals in the Valenca-Itacare, Bahia (Brazil) region - Sampling characterization and ore processing.** Noguti, I.; Feitosa, J.A. Companhia Baiana de Pesquisa Mineral, Salvador, BA (Brazil). [1989]. 18p. (In Portuguese). Order Number DE89615865/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Important heavy minerals deposits were discovered by CBPM in the townships of Nilo Pecanha and Marau, state of Bahia. Ore dressing tests were conducted at CETEC and the results indicate a good potential. Tests were carried out with the Humphreys spiral, with magnetic and electro-static separators were yielding concentrates of ilmenite with 56.0% TiO/sub 2/and Zircon with 65.0% ZrO/sub 2/.

31389 (INIS-BR–1515) **Comparative study of chemical cold agglomeration between two Brazilian phosphate fines: Patos de Minas and Catalao-Go, Brazil.** Mendes, C.M.; Silveira, I.L. da; Scwabe, W.K. Associacao Latino-Americana de Metalurgia e Materiais, Rio de Janeiro, RJ (Brazil). 1988. 13p. (In Portuguese). (CONF-8811214–: 3. Latin-American colloquium about fatigue and fracture of materials, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1988). Order Number DE89615841/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The viability for using the phosphoric acid as chemical binder for agglomeration of phosphate fines from Catalao, Brazil, based on the good results obtained for pelletizing phosphate fines from Patos de Minas, is studied. The granulometric and chemical characterizations by fluorescence spectrometry and X-ray diffraction were done. The results presented different physical and chemical properties, even thus the phosphoric acid could be used with advantages for chemical agglomeration of phosphate fines from Catalao.

31390 (IPEN-PUB–230) **Evaluation of the mass spectrometric isotope dilution technique with the addition of two tracers (/**

sup 233/U and /sup 235/U) in the determination of the concentration and distribution of uranium in minerals. Shihomatsu, H.M.; Iyer, S.S. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). 1988. 18p. (In Portuguese). Order Number DE89613070/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Mass spectrometric isotope dilution technique employing two tracers (/sup 233/U and /sup 235/U), where two independant values of uranium are obtained in single dilution, is developed for the determination of the uranium in mineral samples with a range of values of 2 to 4000ppm of U. An evaluation of the parameters like reproducibility of the chemical procedure adopted, distribution of uranium in minerals and the effect of isotopic fractionation in the uranium values obtained is made. The precision and accuracy of the technique are discussed by a comparative study of the uranium values obtained in the present study with those by X-ray fluorescence and neutron activation analysis for the same sanples.

31391 (IPEN-PUB–231) **Trace uranium analysis in geological sample by isotope dilution-alpha spectrometry and comparison with other techniques.** Shihomatsu, H.M.; Iyer, S.S. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Dec 1988. 49p. (In Portuguese). Order Number DE89613071/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Establishment of uranium determination in geological samples by alpha spectrometric isotope dilution technique using /sup 233/U tracer is described in the present work. The various steps involved in the method namely, preparation of the sample, electrodeposition, alpha spectrometry, isotope dilution, calculation of the concentration and error statistics are discussed in detail. The experimental parameters for the electrodeposition of uranium, like current density, pH concentration of the electrolyte solution, deposition time, electrode distance were all optimised based on the efficiency of the deposition. The total accuracy and precision of the IDAS using /sup 233/U tracer in the determination of uranium in mineral and granite samples were of the order of 1 to 2% for the concentration range of 50-1500 ppm of U. Our results are compared with those obtained by others workers using similar and different techniques.

31392 (KFK–4524) **Stripping voltammetry of technetium(VII) by means of a glassy carbon electrode chemically modified with a TPAC loaded copolymer film.** Dick, R.; Ruf, H.; Ache, H.J. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie. Feb 1989. 23p. (In German). Order Number DE89774677/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Tetraphenylarsonium chloride (TPAC) as a specifically complexing reagent for pertechnetate ions has been immobilized on the surface of a glassy carbon disk electrode (GCE) by means of a copolymer film prepared from vinylpyridine and vinylferrocene. Immobilization was obtained by anionic exchange reaction between TPAC carrying a negatively charged sulfo group and the pyridine groups quaternized with methyl iodide on the copolymer electrodeposited at the electrode material. This procedure permitted chemical preconcentration of technetium on the electrode surface. After the enrichment step a cathodic stripping voltammetric scan in the DP mode was applied, during which a current peak at -750 mV (vs. Ag/AgCl) was registered, likely due to the reduction of Tc(VII). The influence of different electrode modification procedures on the height of the stripping peak was examined. The dependence of the signal height on the electrode coverage with the quaternized copolymer, the reaction time for incorporation of the sulfonated ligand, the enrichment time of technetium, and the pH and composition of the measurement solution are shown. A detection limit of 1x10/sup -8/M Tc(VII) could be reached in an alkaline and rather dilute NaCl solution after 5 min enrichment time.

31393 (LA-UR–89-1471) **Photoemission spectroscopy of single crystal HTSC materials: A Fermi liquid electronic structure.** Arko, A.J.; List, R.S.; Bartlett, R.J.; Cheong, S.W.; Olson, C.G.; Yang, A.B.; Liu, R.; Gu, C.; Veal, B.W.; Liu, J.Z. Los Alamos National Lab., NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890426–13: Spring meeting of the Materials Research Society, San Diego, California, USA, 24-28 Apr 1989). Order Number DE89012597/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Photoemission spectra from HTSC materials (primarily 123-type), cleaved and measured at 20K, reveal a rich DOS structure which compares favorably with a calculated band structure, except for a residual 0.5 eV shift which may reflect some correlation effects. Band dispersion is observed throughout the valence bands, with clear evidence for a 0.2 eV wide band dispersing through E_F. The orbital character at E_F is a mix of Cu-3d and O-2p. There is unambiguous evidence for a large BCS-like gap ($2\Delta \geq 4kT_c$). 25 refs., 5 figs.

31394 (LBL–27014) **Electron Energy-Loss Spectroscopy: Fundamentals and applications in the characterization of minerals.** Krishnan, K.M. Lawrence Berkeley Lab., CA (USA). Apr 1989. 27p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-880912–30: 196. American Chemical Society national meeting, Los Angeles, California, USA, 25-30 Sep 1988). Order Number DE89013420/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The combined use of an energy-loss spectrometer and an analytical electron microscope with fine probe forming capabilities provides a wealth of information about the sample at high spatial resolution. Fundamental principles governing the physics of the interaction between the fast electron and a thin foil sample, to account for the fine structure in the inelastically scattered fast electron distribution (Electron-Energy Loss Spectroscopy, EELS), will be reviewed. General application of EELS is in the area of low atomic number elements ($Z < 11$) microanalysis, where it significantly complements the more widely used Energy Dispersive X-ray Spectroscopy (EDXS). However, a careful analysis of the low loss plasmon oscillations and the fine structure in the core-loss edges, can provide additional information related to the bonding and electronic structure of the sample. An illustration of this is presented from our study of Cδ diamond residue from the Allende carbonaceous chondrite. Combination of EELS with channeling effects can provide specific site occupation/valence information in crystalline materials. Details of this novel crystallographic method will be outlined and illustrated with an example of the study of chromite spinels. Finally, some pertinent experimental details will be discussed. 7 figs.

31395 (STEV-TB–89-1) **Quantification of micro organisms in biofuels - a quick analytical method.** Stroem, G. Statens Energiverk, Stockholm (Sweden). Feb 1988. 25p. (In Swedish). Order Number DE89766885/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

System 1, composed of dextran, poly(etylene)glycol, buffer (pH 7) and NaCl, separates organic nonmicro-organism particles from fungal spores as well as bacterial cells, hereby giving a good estimate of the total number of micro-organisms in a sample, when using a spectrofotometric detection system. System 2, composed of dextran, poly(etylene)glycol, diethylaminoethyl-dextran, buffer (pH 4.8) and Li/sub 2/SO/sub 4/, accordingly to system 1 separates nonmicro-organism particles from fungal spores as well as bacterial cells from fungal spores. Spektrofotometric analysis of the upper phase of this system provides information about the total amount of spores in a sample. By combining the two systems, the amount of fungal spores and bacterial cells in a material subjected to extraction, can be estimated. The two systems show a high degree of separation both for humus-particles originating from peat but also for particles originating from forest residuals (90-95% for system 1 and 2 respectively). Pure cultures of storage fungi i.e., Aspergillus fumigatus, Aspergillus niger, Cladosporum cladosporioides, Penicillum piceum, Paecilomyces variotii, Trichoderma viridie all partition in the upper phase (80-100%) of system 1 and 2. The corresponding value for common storage bacteria i.e., Bacillus subtilis and Streptomyces griseus were around 75-95% in system 1 and <10% in system 2. Separation experiments with these micro-organisms mixed with a suspension of homogeneized peat containing wood residues showed a high recovery (75-95%) of the organisms added.

31396 **Fifth symposium on separation science and technology for energy applications.** Bell, J.T.; Watson, J.S. (eds.). 2208p. Marcel Dekker, Inc., New York, NY (1988). (CONF-871038–: 5.

symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The Fifth Symposium on Separation Science and Technology for Energy Applications was held in Knoxville, Tennessee, October 26-29, 1987. This was the fifth of a series of symposia, held biannually, to bring together practitioners of this diverse discipline in order to exchange knowledge both within and among their specialties on topics related to energy production, utilization, and conservation. The symposium was organized and conducted under the sponsorship of the US Department of Energy, the American Chemical Society, the American Institute of Chemical Engineers, and Oak Ridge National Laboratory. Abstracts are prepared for sixty-six papers.

31397 Photoelectron spectroscopy of biologically active molecules. XVI. Benzophenone derivatives. Klasinc, L. (Rudjer Boskovic Institute, Croatia (Yugoslavia)); Novak, I.; Sabljic, A.; McGlynn, S.P. pp. 8 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

The interaction of a carbonyl group with two adjacent aromatic units is discussed. The outer valence electronic structure of compounds of general formula Ph-CO-Ar, where Ar is phenyl, substituted phenyl, furyl and thienyl, is determined from their gas phase photoelectron spectra. Particular attention is paid to biologically active derivatives of 2-amino-5-chlorobenzophenone.

31398 Mass and energy selective ion partitioning in a two-section Fourier transform ion cyclotron resonance spectrometer cell. Kerley, E.L. (Texas A & M Univ., College Station (USA)); Russell, D.H. *Analytical Chemistry (USA),* 61(1): 53-57 (1 Jan 1989). DOE Contract AS05-82ER13023.

A method for ion isolation due to selective partitioning in a two-section Fourier transform ion cyclotron resonance cell is described. The limitation on ion cyclotron radius imposed by the conductance limit aperture is exploited to isolate ions. This method allows ions to be isolated according to: (i) mass, (ii) translational energy in the cyclotron orbit, and (iii) spatial location. The general utility of the technique for ion-molecule studies is discussed, and extension to analytical applications is straightforward.

31399 Characterization and optimization of flame photometric detection in supercritical fluid chromatography. Olesik, S.V. (Ohio State Univ., Columbus (USA)); Pekay, L.A.; Paliwoda, E.A. *Analytical Chemistry (USA),* 61(1): 58-65 (1 Jan 1989). DOE Contract AC22-87PC79887.

The flame of photometric detector (FPD) was optimized for the analysis of organosulfur compounds by supercritical fluid chromatography (SFC). The flame gases used in this study were hydrogen and oxygen. The optimum flow rates for hydrogen and oxygen were determined. The effect of placing the pressure restrictor different distances away from the flame was examined. The flame chemistry that results when carbon dioxide flows into a hydrogen-rich flame was characterized. The coelution of hydrocarbons with sulfur-containing compounds did not markedly quench the sulfur dimer signal for concentrations that were appropriate for capillary SFC. Detection limits as low as 0.1 ng of sulfur were achieved with detectivities of 8 pg/s.

31400 Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry. Plantz, M.R. (Ames Lab., IA (USA)); Fritz, J.S.; Smith, F.G.; Houk, R.S. *Analytical Chemistry (USA),* 61(2): 149-153 (15 Jan 1989). DOE Contract W-7405-ENG-82.

An on-line sample treatment method has been developed to separate analyte metals from alkali and alkaline-earth elements and anions for inductively coupled plasma mass spectrometry (ICP-MS). The reagent bis(carboxymethyl)-dithiocarbamate is used to complex, V, Cr, Ni, Co, Cu, Mo, Pt, Hg, and Bi. These complexes are adsorbed into a polystyrene-divinylbenzene resin column at acidic conditions. The interfering matrix ions are not complexed and pass through the column unretained. The metal complexes are then removed from the column with a basic eluent. No organic solvent is necessary to displace the metal complexes. The technique is applied successfully to standard samples of urine and seawater. Detection limits are in the range 8-80 ng L^{-1}.

31401 Evaluation of pulsed fast-atom bombardment ionization for increased sensitivity of tandem mass spectrometry. Tecklenburg, R.E. Jr. (Texas A & M Univ., College Station (USA)); Castro, M.E.; Russell, D.H. *Analytical Chemistry (USA),* 61(2): 153-159 (15 Jan 1989). DOE Contract AS05-82ER13023.

The use of pulsed valves for performing fast-atom bombardment (FAB) ionization on a sector ion-beam mass spectrometer is described. The objective of this work is to establish new methods for improving the sensitivity of tandem mass spectrometry. This paper deals with the use of pulsed FAB for improving total ion yields as well as signal-to-noise ratios for collision-induced dissociation and laser-ion beam photodissociation. Pulsing the neutral gas pressure used for FAB ionization results in neutral primary beam densities much greater (by a factor of 10) than those obtainable for continuous FAB. This approach yields enhancements for total ion yields and collision-induced dissociation signals by a factor of 15, while larger gains (> 28) are measured for the comparable photodissociation experiment.

31402 A simple purge system for determination of sulfur using the direct-current plasma. McCreary, T. W. (Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061(US)); Long, G. L. *Applied Spectroscopy (USA),* 43(1): 170-171 (Jan 1989).

In this note, we will describe a purge system for direct current-plasma (DCP) used for sulfur analysis which is simple to constructand which uses a total of only 5L/min of argon for the optical pathand monochromator; this purge system has been found to be satisfactoryfor viewing of the sulfur emission lines from 180 to 183 nm. (AIP)

31403 Capillary isotachophoresis mass spectrometry. Udseth, H.R. (Pacific Northwest Lab., Richland, WA (USA)); Loo, J.A.; Smith, R.D. *Analytical Chemistry (USA),* 61(3): 228-232 (1 Feb 1989). DOE Contract AC06-76RL01830.

The on-line combination of capillary isotachophoresis (CITP) with mass spectrometry is demonstrated for the first time. The CITP/MS interface is based upon electrospray ionization and is identical with that developed previously for capillary zone electrophoresis (CZE)/MS. Separations were conducted in untreated 100 μm i.d. fused silica capillaries having lengths of 0.6-2.5 m, at voltages up to 35 kV. The method involves elution of the leading electrolyte to the electrospray source followed by a sequence of separated analyte bands (if sufficient time is provided for development) and, finally, the trailing electrolyte. The CITP/MS was demonstrated to allow very high resolution separations of quaternary phosphonium ions and other ionic substances having very small differences in electrophoretic mobilities. Nearly ideal band shapes are obtained in most separations despite the presence of electroosmotic flow. The potential for application to very dilute sample solutions is demonstrated by detection of analytes having 10^{-9} M concentrations, with signal to noise ratios of approximately 10^2 for some components, which as at least 2 orders of magnitude better than CZE/MS. CITP/MS appears to be an attractive complement to CZE/MS for dilute (low ionic strength) solutions since much greater sample sizes can be addressed without loss of efficiency.

31404 Indirect fluorometric detection in gel electrophysics. Hogan, B. L. (Ames Laboratory-USDOE and Department of Chemistry, Iowa State University, Ames, Iowa 50011(US)); Yeung, E. S. *Applied Spectroscopy (USA),* 43(2): 349-350 (Feb 1989). DOE Contract W-7405-ENG-82.

Polyacrylamide gel electrophoresis separates biomolecules by virtueof their inherent charge or size, or a combination of the two. Thiswidely used bioanalytical technique has seen applications in areassuch as the separation of complex mixtures of proteins, gene sequenchingand mapping, and clinical diagnosis. The method displays unmatchedresolution of macromolecules, yet still utilizes detection methods which areslow and labor–intensive. Commonly used methods such as Coomassie Blue andsilver staining can become complicated and may require twenty-four hoursto allow one to visualize the analyte. Autoradiography offers highsensitivity (10–100

pg)for the detection of radio-labelled analytes, butrequires exposure times of hours or days. A sensitive, yet rapid,quantitation method for electrophoresis would be quite useful. This paperdemonstrates the feasibility of employing indirect fluorometry as a rapidand potentially highly sensitive detection scheme for gelelectrophoresis. (AIP)

31405 Fluorometric measurement of aqueous ammonium ion in a flow injection system. Genfa, Z. (Texas Tech Univ., Lubbock (USA)); Dasgupta, P.K. *Analytical Chemistry (USA),* 61(5): 408-412 (1 Mar 1989). DOE Contract FG05-84ER13281.

An automated flow-injection method for NH_3/NH_4^+ involving the ternary reaction of the analyte with o-phthaldialdehyde (OPA) and sulfite is described. The use of malodorous thiol compounds is avoided and the reaction provides much greater sensitivity by either fluorescence (detection limit 300 fmol or 20 nM NH_4^+) or absorption detection compared to the reaction involving 2-mercaptoethanol. The reaction shows considerable selectivity for ammonia over amino acids by a factor of 16 to > 500 for 11 common amino acids studied. The throughput rate is 25 samples/h.

31406 Experimental characterization of the elution profiles of high concentration chromatographic bands using the analytical solution of the ideal model. Golshan-Shirazi, S. (Univ. of Tennessee, Knoxville (USA)); Guiochon, G. *Analytical Chemistry (USA),* 61(5): 462-467 (1 Mar 1989).

Experimental results are compared to the predictions derived from the exact solution of the ideal model of chromatography. Although the efficiency of the column used was around 5000 theoretical plates, there is a close agreement between the band profiles recorded for large samples injected on different chromatographic systems and those predicted by the ideal model. The variations of the apparent column capacity factor and apparent column efficiency are also in excellent agreement with the theoretical results. This work confirms earlier findings, that the band profiles can be scaled when the adsorption isotherm of a compound in a chromatographic system follows the classical Langmuir behavior. The authors results can be used for a rapid determination of adsorption isotherms and an accurate prediction of the band profiles at various column loadings. They also permit the prediction of the dependence of the retention time and apparent column efficiency on the sample size.

31407 Transient infrared emission spectroscopy. Jones, R.W. (Iowa State Univ., Ames (USA)); McClelland, J.F. *Analytical Chemistry (USA),* 61(7): 650-656 (1 Apr 1989). DOE Contract W-7405-ENG-82.

Transient infrared emission spectroscopy (TIRES) is a new method that produces analytically useful emission spectra from optically thick, solid samples by greatly reducing self-absorption of emitted radiation. The method reduces self-absorption by creating a thin, short-lived, heated layer at the sample surface and collecting the transient emission from this layer. The technique requires no sample preparation and may be applied to both moving and stationary samples. The single-ended, noncontact TIRES measurement geometry is ideal for on-line and other remote-sensing applications. TIRES spectra acquired via a Fourier transform infrared spectrometer on moving samples of coal, plastic, and paint are presented and compared to photoacoustic absorption spectra of these materials. The TIRES and photoacoustic results are in close agreement as predicted by Kirchhoff's law.

31408 Diode laser initiated resonance ionization mass spectrometry of lanthanum. Shaw, R.W. (Oak Ridge National Lab., TN (USA)); Young, J.P.; Smith, D.H. *Analytical Chemistry (USA),* 61(7): 695-697 (1 Apr 1989). DOE Contract AC05-84OR21400.

Three two-color 1 + 1 + 1 resonance ionization processes were demonstrated for lanthanum, with the initial optical transition excited by an inexpensive GaAlAs diode laser operating at 753.93 nm. A 6-kHz copper vapor laser pumped dye laser was utilized for the subsequent excitation and ionization steps; lanthanum-139 ions were created when 566.46-, 584.86-, or 586.54-nm photons were present in conjunction with the diode laser light. A practical resonance ionization mass spectrometric instrument employing only diode lasers for excitation of bound-bound atomic transitions is envisioned.

31409 Silver-coated fumed silica as a substrate material for surface-enhanced raman scattering. Alak, A.M. (Oak Ridge National Lab., TN (USA)); Vo-Dinh, T. *Analytical Chemistry (USA),* 61(7): 656-660 (1 Apr 1989). DOE Contract AC05-84OR21400;AC05-76OR00033.

A new and simple type of substrate for surface-enhanced raman scattering (SERS) was investigated. This new substrate is based upon silver-coated fumed silica on surfaces such as glass plates or microscopic slides. Fumed silica, which has submicrometer size structure provides the surface roughness necessary for SERS process. The effects of several experimental factors, including the type of fumed silica, the concentration of the microparticles, and the silver layer thickness were investigated. The SERS spectra of various organic species were used to demonstrate the efficiency and applicability of the new substrate. Fumed-silica-based substrates offer many advantages, since they are simple to prepare and easy to handle. The basic material, fumed silica, is also commercially available at very low cost.

31410 Separation and characterization of colloidal materials of variable particle size and composition by coupled column sedimentation field-flow fractionation. Jones, H.K. (Univ. of Utah, Salt Lake City (USA)); Giddings, J.C. *Analytical Chemistry (USA),* 61(7): 741-745 (1 Apr 1989). DOE Contract FG02-86ER60431.

Coupled column field-flow fractionation (FFF), in which a narrow fraction collected from one run is reinjected for a second FFF run under different conditions, is shown to be a multidimensional technique analogous to coupled column chromatography. Bu using different carrier densities in successive sedimentation FFF stages, this approach is theoretically capable of unraveling both the size and density characteristics of the components of complex colloids. This concept is tested here by preparing simple binary mixtures of polystyrene (PS) and poly(vinyl chloride) (PVC) latex particles; coupled column FFF is then used to recover size and density information on the PS latex despite the presence of the PVC contaminant. The problem of transferring enough of a sample fraction from the first stage to the second to provide an adequate detector signal is approached by three concentration methods: split-outlet concentration, on-channel concentration, and centrifugation. All work reasonably well, but improvements in some of these techniques would greatly simplify the practical usage of coupled column FFF.

31411 Capillary gas chromatographic separation of alkyl nitrates and peroxycarboxylic nitric anhydrides. Roberts, J.M. (Brookhaven National Lab., Upton, NY (USA)); Fajer, R.W.; Springsten, S.R. *Analytical Chemistry (USA),* 61(7): 771-772 (1 Apr 1989). DOE Contract AC02-76CH00016.

The measurement of peroxycarboxylic nitric anhydrides (so-called PAN-type compounds) has become a crucial part of atmospheric chemical research. One such compound, peroxyacetic nitric anhydride (PAN), has been shown to comprise a large fraction of photochemically active nitrogen, which is often referred to as reactive odd-nitrogen (NO_y). PAN, while originally discovered and measured by IR spectroscopy, is routinely measured by gas chromatography with electron capture detection (GC/ECD). The packed columns used for this analysis have changed little in the past 25 years and have consisted mainly of low-molecular-weight Carbowax liquid phases on deactivated solid supports. Alkyl nitrates ($RONO_2$) have emerged as another class of compounds likely to contribute to atmospheric NO_y, and preliminary measurements of them have been made by capillary GC/ECD. The authors wish to report here preliminary studies on use of capillary gas chromatographic columns for the simultaneous analysis of both PAN-type compounds and alkyl nitrates in the presence of ambient atmospheric halogenated hydrocarbons. The goal of this research has been the development of a single method for the atmospheric measurement of PAN and peroxypropionic nitric anhydride (PPN), as well as alkyl nitrates in the size range C_1-C_5. Capillary columns are a logical choice for such a method due to increased resolution and potentially shorter analysis times relative to packed columns.

31412 Solvent extraction with organophosphines - commercial & potential applications. Rickelton, W.A. (American Cyanamid Company, Niagara Falls, Ontario (Canada)); Boyle, R.J. *Separation Science and Technology (USA),* 23(12-13): 1227-1250 (Oct 1988).

(CONF-871038--: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Phosphine was discovered in 1783 by Gengembre but, until Cyanamid began work in 1955, very little research had been concentrated on replacing one or more of the phosphorus to hydrogen bonds by phosphorus to carbon bonds. This paper describes that part of this research which focused on creating and reducing to commercial practice new organophosphine extractants for both metals and organic solutes. The chemistry involves the reactions of phosphine with alpha-olefins to produce di- and trialkylphosphines. These derivatives can then be oxidized or thionated to afford four different types of reagents. The phosphine oxides and sulfides which are obtained function as extractants by a solvating mechanism while the phosphinic and dithiophosphinic acids produced are cation exchange reagents. The properties and performance characteristics of each of these classes of compounds are described. A new extractant, CYANEX 925, is introduced. Commercial, as well as potential, applications for all of these extractants are discussed.

31413 Crown ethers as solvent extraction reagents: where do we stand?. McDowell, W.J. (Oak Ridge National Lab., TN (USA)). *Separation Science and Technology (USA),* 23(12-13): 1251-1268 (Oct 1988). (CONF-871038--: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

It is perhaps prophetic that among the first applications of crown ethers was their use as solvent extraction reagents. In 1962 the compound 2,3,11,12-dibenzo- 1,4,7,10,13,16-hexaoxacycloocta-2, 11-diene, now mercifully called dibenzo-18-crown-6, was identified and was found to form alkali-metal-salt adducts that were soluble in organic solvents. These serendipitously discovered extraction properties of crown ethers were later used to compare the complex-formation properties of metal ions with crown ethers, and it was observed that salts of organophilic anions were more readily transferred to aprotic solvents. Picrate salts were extensively used in this role. However, those seeking analytical or process applications of the unusual complexing abilities of macrocycles needed the aqueous anion to be one of the more common mineral acid anions such as chloride, nitrate, or sulfate. This problem was circumvented in the late 1970's when it was discovered that crown ethers mixed with an organophilic cation exchanger such as alkyl phosphoric, alkyl-aryl sulfonic, or carboxylic acid, would produce synergistic extraction systems having excellent and selective affinities for a large number of metal ions. In 1981, macrocyclic compounds with attached carboxylic groups were synthesized and found to be excellent extractants. In addition to liquid-liquid extraction, much work has been done using macrocycles as separation agents in membranes and resin beads. Fundamental research is now beginning to provide the stoichiometries and structures of some of the organic-phase complexes produced and an understanding of the reactions in these extraction systems. At the same time, some potential uses of these systems are beginning to be identified.

31414 Enhanced solvent extraction with water-in-oil microemulsions. Osseo-Asare, K. (Pennsylvania State Univ., University Park (USA)). *Separation Science and Technology (USA),* 23(12-13): 1269-1284 (Oct 1988). (CONF-871038--: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

This paper examines theoretically the conditions which favor enhanced extraction when a microemulsion phase containing a surfactant and a chelating agent is used as the solvent extraction organic phase. A general thermodynamic model of liquid-liquid distribution in reversed micellar systems is presented. The model treats the reversed micellar aggregates of the surfactant HA as a pseudophase and considers (a) the partition of a chelating extractant (HL) between the continuous organic phase and the reversed micellar pseudophase, (b) transfer of the metal ion M^{z+} into the continuous organic phase via reaction with HA monomers, (c) partition of the M^{z+}-HA complex between the continuous organic phase and the reversed micellar pseudophase, (d) reaction of the M^{z+}-HA complex with HL in the reversed micellar pseudophase, and (e) partition of the HL-containing complex between the reversed micellar pseudophase and the continuous organic phase. Quantitative expressions are derived that permit one to identify the chemical parameters that influence the liquid-liquid transfer process and therefore permit one to undertake the rational design of microemulsion formulations for specific applications.

31415 The use of diffuse reflectance infrared spectroscopy for studies of molecular sieve catalysis. Johnson, S. A. (Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Illinois 60439(US)); Rinkus, R. -M.; Diebold, T. C.; Maroni, V. A. *Applied Spectroscopy (USA),* 42(8): 1369-1374 (Nov 1988). DOE Contract W-31-109-ENG-38.

Diffuse reflectance Fourier transform infrared spectroscopy (DRIFT)in conjunction with gas chromatography has been used to investigate theinteraction of light hydrocarbons with the molecular sieve catalystH-ZSM-5. Experiments were conducted in a controlled-environment(temperature, gas composition) diffuse reflectance cell interfaced withan on-line gas chromatograph. The reactivity of CH_3OH, CH_3CH_2OH, and$CH_2{=}CH_2$ on H-ZSM-5 has been investigated by observing the changesin intensity of the framework hydroxyl stretching vibrations asa function of the type of reactant, temperature, and product mix. C-Hstretching vibrations of the organic fragments that form in the molecularsieve channels and pores are also observed in these experiments, andthey too are correlated with reactant, temperature, and products mix withthe use of spectra subtraction techniques. Important functional featuresof molecular sieve catalysis detectable by the DRIFT method include(1) the creation of protonated sites during calcining of the synthesistemplate (the process by which the catalytically active form of thesieve material is produced); (2) the labile nature of these protons as afunction of reactant and temperature; and (3) the onset of coking of themolecular sieve as a result of extended use or use at higher temperatures.

31416 Synergistic solvent extraction of manganese by macrocyclic crown ethers in combination with didodecylnaphthalene sulfonic acid: effect of macrocycle substituents. Chadwick, R.B. (Oak Ridge National Lab., TN (USA)); McDowell, W.J.; Baes, C.F. Jr. *Separation Science and Technology (USA),* 23(12-13): 1311-1324 (Oct 1988). (CONF-871038--: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Crown ethers in combination with organophilic cation exchangers synergize the extraction of certain metal ions from aqueous solutions, and their selectivity has been thought largely dependent on the correspondence between the crown ether's cavity diameter and the metal ion diameter. This work focuses on two crown ethers, tert.-butylbenzo-15-crown-5 (tBB15C5), and tert.-butylcyclohexano-15-crown-5 (tBC15C5) each of which has a cavity diameter of 1.7 to 2.2×10^{-10} m, and their extraction of Mn^{2+} (ionic diameter 1.4 to 2.2×10^{-10} m) from aqueous nitrate solutions. The organophilic cation exchanger used was didodecylnaphthalene sulfonic acid (HDDNS). The data show no observable complexes of the manganese salt of HDDNS with the benzo-substituted crown, tBB15C5, but the cyclohexano-substituted crown, tBC15C5, forms a strong complex with $Mn(DDNS)_2$. The system tBC15C5/HDDNS is an effective phase-transfer agent for manganese. Since the cavities in the two crown ethers are the same size, it appears that the differences observed between the benzo- and cyclohexano-substituted crowns are due to their different substituents.

31417 Selective extraction of Cu^{2+} and Ag^{+} ions from sulfuric acid by synergistic combinations of tetradentate thia macrocycles with didodecylnaphthalene sulfonic acid. Moyer, B.A. (Oak Ridge National Lab., TN (USA)); Westerfield, C.L.; McDowell, W.J.; Case, G.N. *Separation Science and Technology (USA),* 23(12-13): 1325-1344 (Oct 1988). (CONF-871038--: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The aqueous-insoluble thia macrocycles tetrathia-14-crown-4 (TT14C4) and tetrathia-16-crown-4 (TT16C4) strongly and selectively synergize the extraction of Cu^{2+} and Ag^{+} ions from aqueous sulfuric acid solutions by the organophilic cation exchanger didodecylnaphthalene sulfonic acid (HDDNS) in toluene diluent. Over a range of sulfur acid concentrations, the selectivity is given by the order $Ag^{+} > Cu^{2+} > Mn^{2+}$, Fe^{2+}, Fe^{3+}, Co^{2+}, Ni^{2+}, and Zn^{2+}, where synergism occurs only for Ag^{+} and Cu^{2+}. Selectivity factors greater

than 300 have been achieved for Cu^{2+} over ubiquitous Fe^{3+}. The synergistic extraction of Cu^{2+} and Ag^{+} was explored as a function of sulfuric acid concentration, relative concentration of macrocycle vs. HDDNS, and loading.

31418 Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether. Ensor, D.D. (Tennessee Technological Univ., Cookeville (USA)); Nicks, M.; Pruett, D.J. *Separation Science and Technology (USA),* 23(12-13): 1345-1353 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

An aza-crown ether, 4,13-didecyl-1,7,10,16-tetraoxa-4,13-diazacyclooctadecane (K22DD) has been shown to have a synergistic effect on the extraction of trivalent lanthanides and actinides by thenoyltrifluoroacetone (HTTA). The extraction of Am(III), Cm(III), Am(III), Eu(III), Ce(III), and Pm(III) from an aqueous acetate buffer system (pH = 4.8) into HTTA/K22DD/chloroform phase was studied at 25°C. Distribution coefficients were measured as a function of HTTA concentrations, K22DD concentration, and pH user radiotracer techniques. The synergistic species was determined from these studies to be M(TTA)3 · KSSDD. The results show that the presence of K22DD synergizes the extraction of each of the metals studied by factors of approximately 10^4-10^5. Slightly larger organic phase stability constants were measured for the trivalent actinides relative to the trivalent lanthanides.

31419 Monolayer behavior of hydroxyoxime extractants. Chaiko, D.J. (Pennsylvania State Univ., University Park (USA)); Osseo-Asare, K. *Separation Science and Technology (USA),* 23(12,13): 1423-1434 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Efforts to elucidate solvent extraction mechanisms in hydrometallurgical systems have generally been hindered by a lack of physico-chemical data pertaining to the interfacial properties of organic-soluble extractants and their metal complexes. In an effort to address this situation, a Langmuir film balance was used to characterize the interfacial properties of purified metal extractants spread as monomolecular films at the air/water interface. This interfacial system was used as a model for studying the interactions of the extractant films with the aqueous phase. The metal extractants used in this study were: the anti-isomer of 5,8-diethyl-7-hydroxy-6-dodecanone oxime (DEDO, the active extractant in LIX63, Henkel), and the anti-isomer of 2-hydroxy-5-nonylbenzophenone oxime (HBPO, the active extractant in LIX65N, Henkel). Both equilibrium and dynamic film properties of single component and mixed monolayers were examined. The effects of aqueous phase copper ion on the equilibrium properties of these extractant monolayers were also investigated.

31420 Thermodynamic modeling of chemical equilibria in metal extraction. Chaiko, D.J. (Argonne National Lab., IL (USA)); Fredrickson, D.R.; Reichley-Yinger, L.; Vandergrift, G.F. *Separation Science and Technology (USA),* 23(12,13): 1435-1451 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Models of equilibrium extraction data are being developed for use in computer simulations of metal extraction processes. The correlations are based on chemical mass action principles in which the effects of metal complexation and aqueous phase activity coefficients are considered. Activity coefficients in mixed electrolyte solutions at high ionic strengths are calculated using methods available in the literature. This modeling approach is demonstrated for HNO_3 extraction with both the PUREX and TRUEX solvents and for Am^{3+} extraction by octylphenyl-N,N-diisobutylcarbamoylmethylphosphine oxide, which is the primary extractant in the TRUEX solvent.

31421 Analysis of cobalt extraction by di-(2-ethylhexyl) phosphoric acid in a continuous flow stirred tank with a laser capillary spectrophotometer. Bae, J.H. (Syracuse Univ., NY (USA)); Tavlarides, L.L.; Stamatovic, M. *Separation Science and Technology (USA),* 23(12,13): 1453-1472 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

A laser capillary spectrophotometric technique is used to study and quantify the dispersed phase mixing effects on the performance of a one liter continuous flow reactor for the cobalt-di-(2-ethylhexyl) phosphoric acid extraction system. Bivariate distribution data show that, as the RPM increases, the drop size and drop concentrations change from widely to narrowly distributed, the former tending toward small drop sizes and the latter tending toward higher concentrations. Comparisons between the Monte Carlo simulation model predictions and experimental results, using an aqueous film reaction model, indicates that the simulation predicts the size distribution closely, the Sauter mean diameter within 10% error, and the extraction efficiently within 15% error.

31422 Convergence characteristics of augmented Hessian models for separations. Frantz, R.W. (Univ. of South Carolina, Columbia (USA)); Van Brunt, V. *Separation Science and Technology (USA),* 23(12,13): 1503-1521 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Previous research has shown that the form and number of MESH equations used to describe distillation/extraction systems can change both the linearity and convergence characteristics. In this paper, the structures of the equation sets for distillation and extraction models are analyzed in terms of the form of the three dimensional Hessian associated with them. It is known that for highly nonlinear equilibrium stage problems the N(2C+1), N(2C+3) variable forms used in the Naphthali-Sandholm model are more difficult to converge than newer models of Ricker-Nakashio-King and Krishnamurthy-Taylor that have N(4C) and N(5C+1) variables respectively. The convergence behavior of specific equation sets that augment the size of the Hessian are compared with the standard forms. Alternative models specifically designed to augment the Hessian are analyzed in terms of their convergence behavior. The convergence behavior is compared to MESH equation models. By creating models that specifically increase the equation set at points known to be poorly scaled and at the nonlinearity locations, improved convergence rate and solution stability can be achieved.

31423 Modeling the simultaneous transport of two acid gases in tertiary amines with reversible reactions. Al-Ghawas, H.A. (Univ. of California, Santa Barbara (USA)); Sandall, O.C. *Separation Science and Technology (USA),* 23(12,13): 1523-1540 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The objective of this work is to develop a model for the simultaneous mass transfer of two acid gases in tertiary amines accompanied by reversible chemical reactions. The model has been applied to the industrially important system of simultaneous absorption or desorption of CO_2 and H_2S in aqueous methyldiethanolamine (MDEA). In most applications the treated gas must be virtually free of H_2S; however, it is often not necessary or economical to remove substantial amounts of CO_2. Hence, selective removal of H_2S from gas streams such as natural or synthetic gases which contain CO_2 is desirable. In this research a film theory model describing the simultaneous diffusion and reversible reaction of two gases into reactive liquid has been used to predict the mass transfer enhancement factors of CO_2 and H_2S in aqueous MDEA solutions. The resulting unstable two point boundary value problem has been solved numerically for a range of the dimensionless parameters that characterize an important application for this system. In studying the simultaneous transport of CO_2 and H_2S, it is found that the reversibility of the reactions, under certain conditions, causes desorption to take place although absorption would be expected on the basis of overall driving forces. This showed that not only enhancement factors larger but also smaller than unity and even negative values are possible.

31424 Use of high-gradient magnetic fields for the separation of macromolecules. Scott, T.C. (Oak Ridge National Lab., TN (USA)); Brumfield, T.L. *Separation Science and Technology (USA),* 23(12,13): 1563-1572 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

High gradient magnetic field separation (HGMS) has been used to separate several types of > 1 μm sized ferro- or paramagnetic particles from bulk streams. The majority of the studies have been carried out using a single ferromagnetic wire or wire mesh to produce the field gradients necessary for particle capture. The purpose of this paper is to examine the possibility of using HGMS on < 1 μm entities for the purpose of macromolecular separations. Preliminary experimental results demonstrate that HGMS techniques can be used to capture 0.1 μM diam latex beads from a paramagnetic salt solution passing through a columnar bed of ferro-magnetic spheres.

31425 Depletion of aqueous nitrous acid in packed towers. Crawford, D.B. (Univ. of Tennessee, Knoxville (USA)); Counce, R.M. *Separation Science and Technology (USA),* 23(12,13): 1573-1594 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The depletion of aqueous nitrous acid was studied at 298 K and at slightly greater than atmospheric pressure. Solutions containing nitrous and nitric acids were contacted with nitrogen in towers packed with 6- and 13-nm Intalox saddles. The results indicate the existence of two depletion mechanisms for the conditions studied - liquid-phase decomposition and direct desorption of nitrous acid. Models based on mass-transfer and chemical-kinetic information are presented to explain the experimental results.

31426 CO_2 separation using facilitated transport ion exchange membranes. Noble, R.D. (National Bureau of Standards, Boulder, CO (USA)); Pellegrino, J.J.; Grosgogeat, E.; Sperry, D.; Way, J.D. *Separation Science and Technology (USA),* 23(12,13): 1595-1609 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The use of ion-exchange membranes as supports for facilitated transport of CO_2 is demonstrated. Two different ionomer films were evaluated. The ionomers were a perfluorosulfonic acid film and a sulfonated polybenzimidazole film. Sodium (Na^+) was exchanged into the membrane for diffusion experiments and ethylenediamine (EDA) was exchanged for facilitated transport experiments. The results indicate that thin perfluorosulfonic acid membranes provide the best CO_2 flux and can also provide exceptionally high selectivity.

31427 Advanced gas separation membrane materials: rigid aromatic polyimides. Kim, T.H. (Univ. of Texas, Austin (USA)); Koros, W.J.; Husk, G.R. *Separation Science and Technology (USA),* 23(12,13): 1611-1626 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Permeabilities, solubilities, diffusivities, and selectivities for He/CH_4 and Co_2/CH_4 gas pairs are reported for four aromatic polyimides having systematic variations in intersegmental packing and intrasegmental mobility. As intersegmental packing is disrupted by bulky substituents, gas diffusivities are generally increased, but diffusivity selectivities, of He/CH_4 and CO_2/CH_4 are correspondingly decreased. Simultaneous suppression of intrasegmental mobility and intersegmental packing, however, yields significant increases in both diffusivity and diffusivity selectivity, and consequently in permeability and permselectivity. For example, packing-disrupted and mobility-restricted 6FDA-DAF polyimide provides significantly higher permeabilities and permselectivities than commercially available polymers currently being used as membrane materials.

31428 Comparison of bulk, emulsion, thin sheet supported, and hollow fiber supported liquid membranes in macrocycle-mediated cation separations. Izatt, R.M. (Brigham Young Univ., Provo, UT (USA)); Lamb, J.D.; Bruening, R.L. *Separation Science and Technology (USA),* 23(12,13): 1645-1658 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The advantages, disadvantages, and possible applications of macrocycle-mediated bulk, emulsion, supported and hollow fiber liquid membranes have been investigated. The relative transport rates of the alkali metal cations and of Zn(II), Cd(II) and Hg(II) in single and competitive cation experiments are studied and compared in the different membrane types. The four membrane types demonstrate similar selectivities but significantly different cation fluxes under comparable conditions using analogous macrocyclic carriers. The degree of distribution of the macrocycle to the organic membrane which is necessary for significant transport varies dramatically among the membrane types, each of which requires unique solvent characteristics. In the experiments, either 18-crown-6, dicyclohexano-18-crown-6, or 4,4'(5)bis(1-hydroxyheptylcyclohexano)-18-crown-6 were incorporated into bulk (chloroform, methylene chloride), emulsion (toluene), supported (phenylhexane) and hollow fiber (phenylhexane or 1-octanol) liquid membranes with the membrane solvents shown in parentheses.

31429 Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale. Ruppert, M. (Institute of Chemical Engineering, Graz (Austria)); Draxler, J.; Marr, R. *Separation Science and Technology (USA),* 23(12,13): 1659-1666 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Emulsion-Liquid-Membrane-Permeation (LMP) is an operation for the recovery of several harmful substances from industrial waste water streams. Within this process the substance is separated from the waste water and enriched by a factor up to 1000 in the receiving phase depending on the process conditions. The largest experimental experiences are in the separation of Zn, Cd, Pb, Cu, Ni, NH_3 and phenol from aqueous solutions.

31430 Preferential adsorption and selective permeation of alcohol/hydrocarbon mixtures in reverse osmosis. Farnand, B.A. (CANMET Energy Research Labs., Ottawa, Ontario (Canada)); Sawatzky, H. *Separation Science and Technology (USA),* 23(12,13): 1667-1681 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

In binary mixtures of alcohols and hydrocarbons there are two types of reverse osmosis performances. These are selective permeation of the alcohol and selective permeation of the hydrocarbon. Liquid chromatography results have been used to predict the selective permeation of reverse osmosis membranes where the membranes may be difficult to fabricate as well as to determine performance limits in terms of separation. These results are or interest for the production of oxygenated fuel blending agents where specifications require the removal of unreacted methanol for further processing and distillation is not viable.

31431 Supported liquid membrane separation of aluminum from copper leaching liquors. Schultze, L.E. (Department of the Interior, Reno, NV (USA)); Sandoval, S.P.; Eisele, J.A.; Carnahan, T.G. *Separation Science and Technology (USA),* 23(12,13): 1683-1693 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The Bureau of Mines, U.S. Department of the Interior, investigated the separation of aluminum from copper dump leaching liquors using a supported liquid membrane. Aluminum was selectively transported through porous polypropylene impregnated with di(2-ethylhexyl) phosphoric acid in an aliphatic diluent. The effects of variables, such as solution composition, temperature, and extractant concentrations, were measured using a three-level fractional factorial experimental design. Experimental results were used to derive equations for predicting transport rates for aluminum, iron, and copper. The major variables influencing aluminum transport were solution temperature, feed solution pH, aluminum concentration in the fee solution, and extractant concentration. Copper and iron transport rates were almost zero when aluminum transport rates were high. Measured aluminum transport rates under the best conditions of 55°C, pH 3.0, 16 g/L Al^{3+} and 65 pct extractant solution confirmed the predicted value of 210 $\mu g/(cm^2 \times h)$. Transport rates for iron and copper were less than $5 \mu g/(cm^2 \times h)$ under these conditions.

31432 Physico-chemical properties of supported and unsupported γ-Al_2O_3 and TIO_2 ceramic membranes. Gieselmann, M.J. (Univ. of Wisconsin, Madison (USA)); Anderson, M.A.; Moosemiller, M.D.; Hill, C.G. Jr. *Separation Science and Technology (USA),* 23(12,13): 1695-1714 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Supported and unsupported γ-Al_2O_3 and TiO_2 ceramic membranes have been prepared by sol-gel techniques from alkoxide precursors. Several physico-chemical properties of these materials have been determined. N_2 sorption analysis has been used to determined pore size distributions and mean pore sizes. Particle sizes of sols as measured by in situ quasi-elastic light scattering are discussed in the light of SEM analyses of the sintered membranes prepared from these sols. Crack-free unsupported monoliths of Al_2O_3 with thicknesses up to 100 μm have been prepared. Similarly, supported Al_2O_3 and TiO_2 membranes with thicknesses of 0.5 μm have been produced. Preliminary measurements of the permselectivities of supported mechanisms have also been made.

31433 Gas separation properties of phosphazene polymer membranes. McCaffrey, R.R. (Idaho National Engineering Laboratory, ID (USA)); Cummings, D.G. *Separation Science and Technology (USA),* 23(12,13): 1627-1643 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

In this paper the gas separation properties of poly[bis(phenoxy)phosphazene] are reported. Transport behavior was determined by time-lag techniques and correlated with membrane microstructural studies. Test gases were run as pure or single-species gases, which included atmospheric gases, hydrocarbons, sulfur dioxide, and hydrogen sulfide. Transport of atmospheric and hydrocarbon gases was found to be a diffusion controlled process; i.e., correlated with molecular size. Transport of CO_2, H_2S, and SO_2 was found to be a sorption controlled process since high solubilities were measured and transport deviated from the diffusion controlled permeability-size correlation. Membranes were prepared using spin and knife casting techniques. Solvent evaporation rate during the casting process was used to provide membrane microstructures. Rapid evaporation by spin casting resulted in dense homogeneous films, with permeabilities ranging from 2-6 barrers for the slowest (Ar) to the fastest gases (He). Slow evaporation by knife casting (minutes-hours) resulted in a more open polymer structure. Two enhancement effects were observed in the transport behavior of the knife-cast membrane: (1) an overall increase in permeability for all gases depicting the more open membrane structure (ranged from 4-76 barrers for all gases) and (2) an enhancement of the selectivity of gases which exhibited strong solubility effects. Sulfur dioxide and hydrogen sulfide exhibited the greatest selectivity enhancement. The pure gas solubility selectivities for SO_2 and H_2S with respect to the atmospheric and hydrocarbon gases were found to be approximately 1000 and 200 respectively.

31434 Separation of liquid solutions by contained liquid membranes. Sengupta, A. (Stevens Institute of Technology, Castle Point, Hoboken, NJ (USA)); Basu, R.; Prasad, R.; Sirkar, K.K. *Separation Science and Technology (USA),* 23(12,13): 1735-1751 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The technique of contained liquid membranes (CLM) for liquid solution separation is discussed. The CLM is obtained by confining the membrane liquid between two sets of microporous hollow fibers (MHF). The lumen of the hollow fiber carries the feed or the strip solution under proper phase pressure condition vis-a-vis the membrane phase. Various possible structural configurations of the CLM are illustrated with respect to the nature of microporous hollow fiber substrate, the feed solution and the liquid membrane. The contributions of different resistances to the solute transport rate are identified. Some basic experimental data obtained in small CLM permeators are presented for two systems with organic liquid membranes to illustrate how steady state separation is achieved after an initial unsteady period. The considerable advantages of the CLM structure over more traditional liquid membrane techniques such as supported liquid membrane (SLM) with respect to membrane stability, membrane regeneration and feed equilibration are pointed out.

31435 Fouling of thin-channel and tubular membrane modules by dilute suspensions. Ilias, S. (Univ. of Cincinnati, OH (USA)); Govind, R. *Separation Science and Technology (USA),* 23(12,13): 1753-1771 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

In this paper, fouling of thin-channel and tubular ultrafiltration (UF) membrane modules by dilute suspensions have been studied theoretically. A hydrodynamic analysis of fluid-particle system is presented to describe the role of dilute suspensions in fouling such membrane modules. The present analysis assumes that for very dilute suspensions, only inertial effects are important for particulate fouling. Particle trajectory history and hence the fouling is computed from equations of motion for the particles, where the fluid-flow is given by the full solution of Navier-Stokes equation. To simulate the flux decline due to build up of foulant layer on the membrane walls, it is assumed that the deposition of particles on the membrane surface at discrete time interval is a steady state event and thus formulating the fouling problem as an infinite series of successive steady state events. Present simulation results indicate that inertial effects are important and under positive wall permeation flux conditions, particles are encouraged to migrate towards the membrane wall causing so-called membrane fouling by the particulates.

31436 Lowering kraft black liquor viscosity of ultrafiltration. Hill, M.K. (Univ. of Maine, Orono, ME (USA)); Violette, D.A.; Woerner, D.L. *Separation Science and Technology (USA),* 23(12,13): 1789-1798 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

High viscosity is a major factor limiting the percentage total dissolved solids (%TDS) to which kraft black liquor (KBL), a spent pulping liquor, can be concentrated before it is burned to recover its fuel value and its inorganic chemicals. The effect on black liquor viscosity of removing high molecular weight lignin by ultrafiltration of 16% and 24% TDS liquors was studied. Viscosities of ultrafiltration permeates were reduced relative to feed black liquors. When a permeate was concentrated to higher %TDS levels, its viscosity decreased yet further relative to feed samples evaporated to similar solids levels. Retentate viscosity was very high relative to both feed and permeate. Ultrafiltration was carried out at 75°C using polysulfone membranes in a plate-and-frame or hollow fiber system. Flux rates varied greatly depending upon the specific liquor used. Flux was enhanced by increased temperature and increased linear velocity. The membrane molecular weight cutoff (MWCO) typically used was 50,000; increasing 100,000 or 200,000 did not enhance flux.

31437 Stefan-Maxwell analysis of protein transport in porous membranes. Robertson, B.C. (Univ. of Delaware, Newark (USA)); Zydney, A.L. *Separation Science and Technology (USA),* 23(12,13): 1799-1811 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The Stefan-Maxwell multicomponent diffusion equations were used to characterize albumin transport in ultrafiltration membranes in both an unstirred batch filtration device and a well-stirred diffusion cell. The authors developed a theoretical model for ultrafiltrate flux and concentration in the filtration device that explicitly incorporates the effects of protein polarization, protein osmotic pressure, and a flux-dependent sieving coefficient. Experimental data were in good agreement with model predictions, providing quantitative evidence for the predicted dependence of the apparent sieving coefficient on flux. Experimental data in the diffusion cell indicate that the effective albumin diffusivity in the 50,000 molecular weight cutoff membranes was four orders of magnitude less than the Brownian motion value. The Stefan-Maxwell diffusivities evaluated independently in the two experimental systems were in excellent agreement, indicating the general applicability of the Stefan-Maxwell approach to protein transport in ultrafiltration membranes.

31438 Study of nonsteady-state continuous membrane column for gas separation. Yan, Z. (Univ. of Cincinnati, OH (USA)); Kao, Y.K. *Separation Science and Technology (USA),* 23(12,13): 1773-1788 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The permeation and transport processes occurring in a continuous membrane column (CMC) are quite complex, and the system will exhibit inverse response behavior in a certain operating regime. To understand the complex interaction of system variables, this work developed a mathematical model for the CMC and solved the model equations. Dynamic responses of a CMC for the separation

of N_2-CO_2, CO_2-O_2, and O_2-N_2 gas mixtures with capillary silicone rubber membranes are presented. The effect of the membrane permeabilities on the CMC dynamics is examined. Responses of system variables to various disturbances, together with the start-up transient of the system, are discussed. The knowledge of the unsteady-state behavior of the CMC will enable the authors to predict the performance of the CMC and to control the CMC in a dynamic environment.

31439 Proton-ionizable crown compounds: transport of alkali and alkaline earth cations using proton-ionizable triazolo macrocycles. Izatt, R.M. (Brigham Young Univ., Provo, UT (USA)); LindH, G.C.; Bradshaw, J.S.; McDaniel, C.W.; Bruening, R.L. *Separation Science and Technology (USA),* 23(12,13): 1813-1823 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The macrocycle-mediated fluxes of the alkali and alkaline earth metal cations have been determined in H_2O-CH_2Cl_2-H_2O bulk liquid membrane system. Water-insoluble proton-ionizable macrocycles of the triazolo type were used. The proton-ionizable feature allows the coupling of cation transport to reverse H^+ transport. This feature offers promise for the effective separation and/or concentration of alkali metal ions with the metal transport being driven by a pH gradient. A counter anion in the source phase is note co-transported. Transport of the alkali cations only occurred when the source phase pH was greater than the aqueous pK_a value for the carriers. Transport increased regularly with increasing source phase pH. Transport of alkaline earth cations from neutral pH source phases was minimal. The alkali cation selectivity order was $K^+ > Rb^+ > Cs^+ > Na^+ > Li^+$ for the 18-crown-6 sized macrocycles, while little selectivity was observed with the 15-crown-5 sized macrocycle.

31440 Application of the pH-stat technique in Donnan dialysis: effect of anion invasion in the $CoSO_4$/Nafion 117/H_2SO_4 system. Xue, T. (Pennsylvania State Univ., University Park (USA)); Osseo-Asare, K. *Separation Science and Technology (USA),* 23(12,13): 1825-1837 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Cobalt transport during Donnan dialysis in the $CoSO_4$/Nafion 117/H_2SO_4 system was measured with a pH-stat technique. (i.e., the pH in the feed compartment was maintained constant). During the transfer process, Co^{2+} ions moved from the cobalt reservoir to the sink compartment, while hydrogen ions moved in the opposite direction. A standardized NaOH solution was used to neutralize the H^+ ions entering the reservoir compartment, and in the absence of anion invasion, the cobalt flux was determined as $J_{Co2+} = 1/2\ J_{H+}$. The experimental results indicate that for Donnan dialysis experiments involving the high acid concentrations, the invasion of the membrane by the anions associated with the acid can be significant. Since anion transfer is accompanied by the cotransport of protons, it follows therefore that the anion invasion characteristics must be known before the pH-stat technique can be employed successfully. The transport of bisulfate ion (HSO_4^-) through Nafion 117 was measured with the pH-state technique. An invasion-corrected cobalt flux was obtained by substracting the hydrogen flux due to anion invasion from the cobalt flux determined with the above equation. The invasion-corrected flux was in substantial agreement with the flux obtained via cobalt analysis with atomic absorption spectrophotometry.

31441 Studies on gas transport through dry cellulose acetate membranes prepared by solvent exchange technique. Lui, A. (Univ. of Ottawa (Canada)); Talbot, F.D.F.; Sourirajan, S.; Fouda, A.; Matsuura, T. *Separation Science and Technology (USA),* 23(12,13): 1839-1852 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The mechanism of gas transport through pores on the surface of dry cellulose acetate membranes under pressure was identified for membranes prepared by the solvent exchange technique using pure gas permeation rate data. The pure gases were helium, methane and carbon dioxide. The variables involved in the membrane preparation variables involved in the membrane preparation are the shrinkage temperature, the first solvent, the second solvent and the combinations thereof. Different conditions of membrane preparation produce different pore sizes. Depending on this pore size, one of the following mechanisms becomes dominant: Knudsen, surface and size exclusion.

31442 Multicomponent fixed-bed ion exchange: verification of equilibrium coherence theory. Bailey, C.B. (Univ. of Cincinnati, OH (USA)); Pinto, N.G. *Separation Science and Technology (USA),* 23(12,13): 1853-1873 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The coherence method, a technique for modeling multicomponent fixed-bed adsorption with time dependent feed conditions, has been applied to a fixed-bed ion-exchange system under a variety of operating conditions. Theoretically, the method can handle multicomponent systems with initial and feed conditions of any degree of complexity. This paper will present the results of an experimental study to verify the practical utility of the coherence method. A ternary ion-exchange system for K^+, Na^+, Li^+ on a fixed bed of AG-50WX8 resin has been studied. Breakthrough curves, have been obtained for single abrupt, multiple abrupt, and linear influent composition changes. A non-equilibrium model has also been used to describe limiting binary exchange cases. The experimental breakthrough curves have been compared with the predictions of both models.

31443 Separations of compounds of biological and environmental interest by micellar electrokinetic capillary chromatography. Balchunas, A.T. (Univ. of Tennessee, Knoxville (USA)); Swaile, D.F.; Powell, A.C.; Sepaniak, M.J. *Separation Science and Technology (USA),* 23(12,13): 1891-1904 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Important criteria for the effective separation of compounds of biological or environmental interest by micellar electrokinetic capillary chromatography are discussed. Efficiencies of approximately 100,000 plates/meter are achieved in the separations of samples of derivatized amines, aflatoxins, and hydroxy aromatic compounds. Laser fluorometric detection is shown to be capable of detecting subpicogram injected quantities. Organic solvents such as 2-propanol and acetonitrile are added to the aqueous mobile phases normally used to improve the separation of hydrophobic compounds, impart different selectivities, and provide a means for gradient programming. Column diameter is found to influence efficiency, analysis time, and detection.

31444 Evaluation of micellar electrokinetic capillary chromatography for the separation and detection of normal and modified deoxyribonucleosides and deoxyribonucleotides. Griest, W.H. (Oak Ridge National Lab., TN (USA)); Maskarinec, M.P.; Row, K.H. *Separation Science and Technology (USA),* 23(12,13): 1905-1914 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Micellar electrokinetic capillary chromatography allows high resolution separation with very small sample volume requirements. Deoxyribonucleotide oligomers can be resolved on the basis of chain length, nucleic base sequence, and base modification. Sensitivity for dideoxyribonucleosides in the presence of a 1000-fold excess of deoxyribonucleosides is ca. 12 pg with on-column UV absorbance detection.

31445 Novel bifunctional resins in metal ion separations: ion exchange/coordination resins and ion exchange/precipitation resins. Alexandratos, S.P. (Univ. of Tennessee, Knoxville (USA)); Bates, M.; Walder, A.J.; McDowell, W.J. *Separation Science and Technology (USA),* 23(12,13): 1915-1927 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Dual mechanism bifunctional polymers (DMBP's) as metal ion extractants are described within the context of two new examples. The carboxylic acid/pseudocrown resin is a new example of the DMBP class of resins described as ion exchange/coordination resins. The polyethylene glycol ligand within the resin functions as a coordinating site for metal ions which are brought into the resin via ion

exchange with the acid ligand. Initial studies with alkali metal ions are presented. The third general class of DMBP's is also presented. In this case, precipitation is the reaction occurring along with ion exchange thus yielding the ion exchange/precipitation resins. Barium recovery from aqueous solution via barium sulfate precipitation is described.

31446 Uranium recovery from seawater by adsorption. Koske, P.H. (Univ. Kiel (Germany, F.R.)); Ohlrogge, K.; Peinemann, K.V. *Separation Science and Technology (USA),* 23(12,13): 1929-1940 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Results are presented of a 10 weeks field experiment producing uranium from seawater by the so-called adsorber-loop-concept. For the adsorption process polyamidoxin (PAO) granulate has been used with grain sizes between 0.3 - 1.2 mm diameter. The performance of the adsorber and the efficiency of the adsorption process - especially with regard to high volume flows of seawater - are presented.

31447 Rapid determination of burn-up of nuclear fuel - a possible approach. Karunasagar, D. (Indira Gandhi Centre for Atomic Research, Kalpakkam (India)); Joseph, M.; Saha, B.; Matthews, C.K. *Separation Science and Technology (USA),* 23(12,13): 1949-1957 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

High performance liquid chromatography (HPLC) has been used for the separation and estimation of light rare earths by making use of an anion exchanger or a dynamically modified reverse phase column as a cation exchanger. Both these methods were studied and relative performance was assessed from the point of view of their suitability for the determination of burnup of nuclear fuels.

31448 Fluorine gettering by activated charcoal in a radiation environment. Felker, L.K. (Oak Ridge National Lab., TN (USA)); Toth, L.M. *Separation Science and Technology (USA),* 23(12,13): 1959-1968 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Activated charcoal has been shown to be an effective gettering agent for the fluorine gas that is liberated in a radiation environment. Even though activated charcoal is a commonly used getter, little is known about the radiation stability of the fluorine-charcoal product. This work has shown that not only is the product stable in high gamma radiation fields, but also that radiation enhances the capacity of the charcoal for the fluorine. The most useful application of this work is with the Molten Salt Reactor Experiment (MSRE) fuel salt because the radioactive components (fission products and actinides) cause radiolytic damage to the solid LiF-BeF_2-ZrF_4-UF_4 (64.5, 30.3, 5.0, 0.13 mol %, respectively) resulting in the liberation of fluorine gas. This work has also demonstrated that the maximum damage to the fuel salt by $\approx 3 \times 10^7$ R/h gamma radiation is approximately 2%, at which point the rate of recombination of fluorine with active metal sites within the salt lattice equals the rate of fluorine generation. The enhanced reactivity of the activated charcoal and radiation stability of the product ensures that the gettered fluorine will stay sequestered in the charcoal.

31449 Effects of particle shape and size distribution on sorption and flow performance in electrically stabilized expanded beds. Byers, C.H. (Oak Ridge National Lab., TN (USA)); Watson, J.S.; Sisson, W.G. *Separation Science and Technology (USA),* 23(12,13): 1969-1987 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Use of the electrically stabilized expanded bed is an approach to the improvement of the performance of processes in beds of solid sorbents. Particle motion in a fluidized bed of nonconducting particles such as molecular sieves is halted when the bed is frozen by a strong electric field imposed across the bed. This allows sorption performance to approach that of fixed beds while maintaining the low pressure drops which are characteristic of fluidized beds. Beds with axial and radial electrode geometries function equally well in the sorption of carbon dioxide (CO_2) from nitrogen (N_2). The effects of particle shape and particle size distribution on bed stabilization are presented. Particle shape was varied from spherical to the irregular forms that are characteristic of crushed particles. The sorption performance was not appreciably different with particles having various shapes. Particles with a size range from 200 to approximately 1200 μm were blended from individual spherical fractions to create mixtures with peak distributions at both ends of this range. To a first approximation, the distribution of particle sizes did not affect sorption performance. These results demonstrate that both irregularly shaped particles and multiple-sized particles can be stabilized in electric fields, and the stabilized beds behave much like fixed beds of the same materials except that the pressure drops across the beds can be significantly less than those for fixed beds. However, the rate of adsorption in the system used for this study is controlled by diffusion within the particles (actually within the micropores of crystals); so the study did not address the effects of electric stabilization on the gas-film resistance.

31450 Fluidized bed electrowinning of chromium from very dilute solutions. Hu, X. (Univ. of Nevada, Reno (USA)); Bautista, R.G. *Separation Science and Technology (USA),* 23(12,13): 1989-2003 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The Fluidized Bed Electrochemical Reactor (FBER) was used to electrowin chromium from very dilute solutions, ranging in concentration from 0.52 to 3.12 g Cr/l at pH = 2. The cathode consisted of particulate chromium (450-600 μm diam.) with a current feeder made of carbon bars and a tubular lead anode in a cylindrical cell. The current efficiency was in the range of 0.08-0.22. The bed expansion, deposition rate, conversion ratio of Cr(VI) to Cr(III) and voltage - current characteristic of the cell were studied. The results indicate that the use of the FBER will make possible the removal of chromium from very dilute solutions without the introduction of other chemicals which would need to be removed or treated further downstream to satisfy environmental abatement codes.

31451 Model for the recovery of titanium from mixtures of ilmenite and hematite by hydrochloric acid leaching. Liddell, K.C. (Washington State Univ., Pullman (USA)). *Separation Science and Technology (USA),* 23(12,13): 2005-2014 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

A partial equilibrium model has been developed to describe the leaching of $FeTiO_3$ - Fe_2O_3 mixtures by aqueous HCl. The model couples the rates of leaching of the minerals to changes in the solution species concentrations; 23 species concentrations were calculated as a function of leaching time. Solution reactions included in the model include (1) the redox reaction converting Ti(IV) and Fe(II) to Ti(III) and Fe(III); (2) formation of chloro complexes; (3) hydrolysis; and (4) dissociation of H_2O. Ilmenite is more rapidly depleted than hematite, and available data indicate that the time dependence of the leaching reactions is different. Modeling results show that the Ti/Fe concentration ratio drops steeply initially but then gradually rises as the leaching rates change. Of the two oxides, $FeTiO_3$ is consumed first, and thereafter the Ti/Fe(III) ratio again declines. The Fe(II)/Fe(III) concentration ratio behaves similarly. The Ti/Fe and Fe(II)/Fe(II) ratios have simultaneous extrema and plots of these ratios vs. time can, with appropriate adjustments in vertical scale, virtually be superimposed. These changes are greater when the initial molar amounts of $FeTiO_3$ and Fe_2O_3 are approximately equal. They are qualitatively the same, but of much smaller magnitude, when the initial $FeTiO_3/Fe_2O_3$ molar ratio is far from 1.0. The species distributions change in a complex way during leaching; typically, hydroxo species become more important but chloro species become less so. Implications of these results for the selective recovery of titanium will be discussed.

31452 Reverse micelle supercritical fluid separations. Smith, R.D. (Pacific Northwest Lab., Richland, WA (USA)); Fulton, J.L.; Jones, H.K. *Separation Science and Technology (USA),* 23(12,13): 2015-2030 (Oct 1988). DOE Contract AC06-76RL01830. (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Initial results are presented showing the potential applications of reverse micelle supercritical fluid solvents in separation processes. The formation of reverse micelles in subcritical n-alkane continuous

phases is described. Phase diagrams obtained from view-cell studies of micellar and microemulsion phases formed in supercritical fluids are reported and shown to be strongly dependent on pressure. The solubility of AOT in ethane and propane over a range of pressures shows behavior typical of solids in supercritical fluids. The maximum water-to-surfactant ratio (W_o) increased dramatically in both ethane and propane systems as pressure was increased. At 300 bar W_o = 4 for ethane at 37°C and W_o = 12 for propane at 103°C. The initial use of supercritical fluids containing reverse micelles for the extraction of solutes from an aqueous phase, and as mobile phases in chromatography, is described.

31453 Performance of spray, sieve tray, and packed contactors for high pressure extraction. Seibert, A.F. (Univ. of Texas, Austin (USA)); Moosberg, D.G. *Separation Science and Technology (USA),* 23(12,13): 2049-2063 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The performance of various contactors in high pressure extraction service was studied. The mass transfer efficiency of a spray column and columns filled with sieve trays, 1.27 cm ceramic Raschig rings, and no. 15 metal Intalox saddles were obtained from a windowed high pressure extraction column with an internal diameter of 9.88 cm and a column height of 168 cm. The extraction column has an internal diameter of 9.88 cm and a contacting height of 168 cm. Glass windows in the extractor allowed visual observation and photography. Supercritical and liquid carbon dioxide were used to extract isopropanol from water at pressures of 81 to 150 atmospheres and 297 to 318 °L. The sieve tray extractor yielded the highest mass transfer efficiency followed closely by Raschig rings and metal Intalox saddles. The spray column was by far the least efficient. The mass transfer efficiency was observed to be independent of the operating conditions studied in this work. Sauter mean drop diameters and dispersed phase (free) hold-up were also obtained in this work. These data will provide a reliable high pressure mass transfer and hydraulic database for future correlation and design efforts.

31454 Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents. McCully, M.A. (Clemson Univ., SC (USA)); Mullins, J.C.; Thies, M.C.; Hartley, I.J. *Separation Science and Technology (USA),* 23(12,13): 2065-2085 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Equilibrium tie lines and phase densities are presented for acetic acid-water mixtures with near critical propane at 361K and 52 bar. Experimental measurements were obtained with a static technique; the equilibrium phases were directly sampled with high-pressure liquid sample injection valves at the temperature and pressure of interest. The data obtained in this work indicate that near critical propane can be used to facilitate the production of glacial acetic acid from dilute acetic acid-water solutions. Both these experimental data and the authors earlier results for acetic acid-water mixtures with supercritical carbon dioxide have been used to test an equation of state which has recently been developed by Grenzheuser and Gmehling for systems which contain associating fluids. Results indicate that the equation's pure component parameters need to be refitted to represent the critical region more accurately.

31455 Electro-acoustic dewatering (EAD) a novel approach for food processing, and recovery. Muralidhara, H.S. (Battelle Columbus Division, Columbus, OH (USA)); Chauhan, S.P.; Senapati, N.; Beard, R.; Jirjis, B.; Kim, B.C. *Separation Science and Technology (USA),* 23(12,13): 2143-2158 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Separation of liquids from fine particle suspensions plays an important role in many industrial processes. In the past few years a number of technologies have been developed for the separation of slurries with coarse particle suspensions and intermediate particle sizes. However, separation of fine particles from their suspensions can be difficult and prohibitively costly. Battelle has developed a solid/liquid separation technology that utilizes differences in electrokinetic and acoustic properties to enhance the efficiency of conventional solid/liquid separation techniques such as vacuum filters or presses. This method can dewater colloidal techniques. Typical applications of this technology to food processing will be presented. Mechanisms involved during separation will also be discussed.

31456 Filtration behavior of slurries with varying compressibilities. Massuda, M. (Martin Marietta Labs., Baltimore, MD (USA)); Bridger, K.; Harvey, M.; Tiller, F.M. *Separation Science and Technology (USA),* 23(12,13): 2159-2174 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

A novel filtration apparatus allows simultaneous measurements of filtrate volume, hydraulic pressure and cake thickness using slurry volumes on the order of 100 cm^3. Differences in interparticle interactions were studied by varying the barium chloride concentration of 0.38-μm polystyrene latex and filtering at pressures between 2 and 100 psi. Cakes formed from these slurries are highly compressible for concentrations between 0.01M and 0.10M, moderately compressible for the 0.005M concentration, and incompressible for the 0.001M concentration. Plots of filtrate volume versus cake thickness were linear for the incompressible cakes, whereas the compressible cakes showed significant deviations, which were pressure dependent. The pressure distribution for the incompressible cake was found to be essentially linear as predicted from the resistance plots assuming constant α and ϵ. For the highly compressible cakes, most of the pressure drop appears to occur near the cake/medium interface with only small changes occurring at the top of the cake.

31457 Permeation of gas mixtures in cellulose acetate membranes - practical approach to predict the permeation rate CO_2/CH_4 mixture. Fouda, A.E. (National Research Council of Canada, Ottawa); Matsuura, T.; Lui, A. *Separation Science and Technology (USA),* 23(12,13): 2175-2190 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Dry cellulose acetate reverse osmosis membranes of different porosities are prepared by using the solvent exchange method and then shrunk at various temperatures. Permeation of single gases and gas mixtures of CO_2 and CH_4 through these membranes were investigated at various upstream pressures up to 2.4 MPa. The permeation data of a reference gas usually helium was used to characterize the membrane and determine the flow parameters which can be used to predict the performance of that membrane in separating gas mixtures. The Surface Force - Pore Flow model developed in previous investigations can be used to predict the membrane performance using the above method. The prediction using the characterization parameters of the reference gas proved to be unsatisfactory in most cases, since the surface force is highly dependent on the interaction between the specific gas component in the mixture and the membrane.

31458 Fluorescence line narrowing spectrometry of nucleoside-polycyclic aromatic hydrocarbon adducts on thin-layer chromatographic plates. Cooper, R.S. (Iowa State Univ., Ames (USA)); Jankowiak, R.; Hayes, J.M.; Pei-qi, L.; Small, G.J. *Analytical Chemistry (USA),* 60(24): 2692-2694 (15 Dec 1988). DOE Contract W-7405-ENG-82.

Fluorescence line narrowing spectrometry (FLNS) is applied to a polycyclic aromatic hydrocarbon-nucleoside adduct sorbed on a thin-layer chromatography (TLC) plate. A calibration curve over more than 5 decades of concentration is presented and yields a detection limit of ~ 10 fmol. The effects of nonphotochemical hole burning (NPHB) are investigated and discussed. Results indicate that FLN spectrometry can be interfaced with the ^{32}P-postlabeling procedure to provide for high sensitivity and selectivity analysis of TLC spots associated with fluorescing nucleotide adducts.

31459 Determination of selenium metabolites in biological fluids using instrumental and molecular neutron activation analysis. Blotcky, A.J. (Veterans Administration Medical Center, Omaha, NE (USA)); Ebrahim, A.; Rack, E.P. *Analytical Chemistry (USA),* 60(24): 2734-2737 (15 Dec 1988). DOE Contract FG02-84ER13231.

Optimized procedures have been developed for the determination of total selenium, trimethylselenonium (TMSe) ion, and selenite (SeO_3^{2-}) ion in urine and serum and for total selenoamino acids in

urine by anion exchange chromatography and molecular neutron activation analysis. For urine samples containing greater than 40 ng of Se/mL, determination for TMSe and SeO_3^{2-} ion can be performed. For urine samples containing nondetectable SeO_3^{2-} ion whose concentration differential between the total selenium and TMSe is $\geq$ 40 ng of Se/mL, total selenoamino acids can be determined by derivatization and anion exchange chromatography. For urine samples whose differential between total selenium and TMSe + SeO_3^{2-} is greater than 80 ng of Se/mL, a precipitation/coprecipitation technique employing $Ba(NO_3)_2$ and $(NH_4)_2SO_4$ must be performed prior to the subsequent steps. The procedures were evaluated for over 100 specimens from normal and diseased subjects.

31460 Sequential determination of biological and pollutant elements in marine bivalves. Zeisler, R. (National Institute of Standards and Technology, Gaithersburg, MD (USA)); Stone, S.F.; Sanders, R.W. *Analytical Chemistry (USA),* 60(24): 2760-2765 (15 Dec 1988). DOE Contract AC06-76RL01830.

A unique sequence of instrumental methods has been employed to obtain concentrations for 44 elements in marine bivalve tissue. The techniques used were (1) X-ray fluorescence, (2) prompt gamma activation analysis, and (3) neutron activation analysis. It is possible to use a single subsample and follow it nondestructively through the three instrumental analysis techniques. A final radiochemical procedure for tin was also applied after completing the instrumental analyses. Comparison of results for elements determined by more than one technique in sequence showed good agreement, as did results from certified reference material samples analyzed along with the samples. The concentrations found in the bivalve samples ranged from carbon at more than 50% dry weight down to gold at several microgram per kilogram.

31461 Direct heated interface probe for capillary supercritical fluid chromatography/double focusing mass spectrometry. Huang, E.C. (Brigham Young Univ., Provo, UT (USA)); Jackson, B.J.; Markides, K.E.; Lee, M.L. *Analytical Chemistry (USA),* 60(24): 2715-2719 (15 Dec 1988). DOE Contract FG02-87ER60556.

A capillary supercritical fluid chromatograph was occupied to a double focusing mass spectrometer with a direct heated probe interface. The interface contained a fused silica transfer capillary containing a frit restrictor at the end which was heated to a temperature of 300-350°C by resistance heating. The total column effluent was transferred into the mass spectrometer ion source. This interface not only preserved the chromatographic efficiency but also provided for mass spectral detection and identification of various high molecular weight, thermally labile, and polar compounds. Electron-impact and chemical ionization mass spectra of selected natural products and pharmaceuticals were obtained at the low nanogram level.

31462 Surface plasmon polariton enhancement of Raman scattering in Kretschmann geometry. Giergiel, J. (Univ. of California, Irvine (USA)); Reed, C.E.; Hemminger, J.C.; Ushioda, S. *Journal of Physical Chemistry (USA),* 92(19): 5357-5365 (22 Sep 1988). DOE Contract FG03-85ER45196.

This paper presents a theoretical and preliminary experimental evaluation of a Kretschmann prism coupler method used in Raman scattering experiments with molecular adsorbates. The theoretical enhancement of Raman scattering intensity, which can be as high as a factor of 1000, is calculated by using an exact method of 2 X 2 transfer matrices. Preliminary experiments, designed to investigate the feasibility of this technique under ultra-high-vacuum conditions, show that monolayer sensitivity can be practically achieved. The authors discuss the optimum experimental configuration, as well as the factors that can seriously limit achievable enhancement levels.

31463 Trace element determinations with synchrotron-induced x-ray emission. Jones, K.W. (Brookhaven National Lab., Upton, NY (USA)); Gordon, B.M. *Analytical Chemistry (USA),* 61(5): 341A-358A (1 Mar 1989).

Synchrotron radiation-source-produced X-rays make it possible to determine trace element concentrations below 1 ppm in sample volumes of 10^{-9} cm^3 by an extension of conventional X-ray fluorescence techniques. Keith W. Jones and Barry M. Gordon of Brookhaven National Laboratory outline the concepts of the technique and discuss its application to problems in terrestrial geochemistry, biology, and biomedicine.

31464 Quantitation of Auger and X-ray photoelectron spectroscopies. Nebesny, K.W. (Univ. of Arizona, Tucson (USA)); Maschhoff, B.L.; Armstrong, N.R. *Analytical Chemistry (USA),* 61(7): 469A-481A (1 Apr 1989).

Surface analysis using electron spectroscopies is now a well-established and continuously expanding area. With appropriate data treatment procedures, both Auger electron spectroscopy (AES, not to be confused with atomic expression spectroscopy) and X-ray photoelectron spectroscopy (XPS or ESCA) can routinely supply reliable qualitative and semiquantitative characterization of the near-surface region (top 1-100 Å) of most solids. Complex sample matrix and instrumental parameters make quantitation of surface electron spectroscopies a real challenge. Kenneth W. Nebesny, Brian L. Mashloff, and Neal R. Armstrong of the University of Arizona describe approaches that make it possible to obtain reliable compositional information.

4002 Inorganic, Organic and Physical Chemistry

Refer also to citation(s) 30263, 30264, 30270, 30292, 30310, 30311, 30746, 31182, 31249, 31425, 31451, 31452, 31454, 31555, 31601, 31864, 32185

31465 (CNIC–00057) **Solving the non-isothermal kinetic curves of gas-solid reactions by non-linear fitting method.** Ge Qingren. China Nuclear Information Centre, Beijing, BJ (China). 1987. 14p. (In Chinese). (TU–0003). Order Number DE89614723/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Solving the non-isothermal kinetic curves of gas-solid reactions is a subject in question up-to-date. This paper presents a non-linear fitting method on the basis of reviewing the previous methods. The computer programs have been compiled. The solutions may be obtained within five minutes with 441B-III Computer, and graphs of experimental curves and fitting curves can be printed simultaneously. More satisfactory results have been obtained for solving the twenty-eight typical theoretically calculated kinetic curves. The application and limitation of the method are discussed.

31466 (DOE/ER/13569–3) **Transition metal activation and functionalization of carbon-hydrogen bonds: Progress report, December 1, 1988–November 30, 1989.** Jones, W.D. Rochester Univ., NY (USA). Dept. of Chemistry. Jun 1989. 24p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13569. Order Number DE89012949/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This project is directed toward the continued investigation of the fundamental thermodynamic and kinetic factors that influence carbon-hydrogen bond activation at homogeneous transition metal centers. The project is also directed toward the conversion of hydrocarbons into functionalized products of potential use to chemical industry. Our goals during the grant period will be (1) to identify new transition metal complexes capable of activating arene and alkane C-H bonds, (2) to quantitatively evaluate the kinetic and thermodynamic stability of these complexes, and (3) to examine routes for functionalization of the activated hydrocarbons. These studies will also contribute toward the formulation of a unified theory of C-H bond activation that applies to other transition metal complexes. The specific complexes involved in these studies are derivatives of the formulation $(C_5Me_5)Rh(PR_3)(R)H$, $Fe(PMe_3)_2(CNR)_3$, $Ru(PR_3)_4(R)H$, and $Rh(CNR)_3H$. Functionalization will focus upon isocyanide and acetylene insertion reactions. New compounds that activate hydrocarbon C-H bonds include $HRe(PR_3)_5$, $HRe(PR_3)_2(CNR)_3$, $CpRe(PR_3)H_4$, $CpRe(PR_3)_2H_2$, $(\eta^6\text{-}C_6H_6)Re(PPh_3)_2H$, and $MnH_3(dmpe)_2$. In the third year of this project, significant advances have been made in the observation of η^2-arene complexes of $[(C_5Me_5)Rh(PMe_3)]$. The complex $(C_5Me_5)Rh(PMe_3)(\eta^2\text{-phenanthrene})$ has been structurally characterized. Several other η^2-complexes have also been prepared. 17 refs., 4 tabs.

31467 (DOE/ER/13612–1) **Infrared study of carbon deposits on bimetallic catalysts: Final report, September 1, 1986–August**

31, 1989. Eischens, R.P. Lehigh Univ., Bethlehem, PA (USA). Zettlemoyer Center for Surface Studies. 1989. 9p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13612. Order Number DE89013600/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The deposition of coke is the limiting factor in the most important hydrocarbon reactions used to produce gasoline. The consensus view is that coke deposits are complex mixtures which have an overall hydrogen/carbon ratio that is inversely related to the temperature to which the coke has been heated. In line with this concept, coke on catalysts is routinely monitored by analyzing for carbon and hydrogen. A new factor was introduced by infrared studies of coke deposits on alumina, platinum/alumina, rhenium/alumina, and platinum-rhenium/alumina. Bands were observed near 1580 and 1470 cm^{-1} after these catalysts had been exposed to acetylene at 250°C. These bands were attributed to the asymmetric and symmetric stretching vibrations of carboxylates. 7 refs., 3 figs.

31468 (DOE/ER/13912–1) **[Fundamental studies of carbenes and hydrocarbon radicals]: Progress report.** Harvard Univ., Cambridge, MA (USA). [1989]. 7p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER13912. Order Number DE89012375/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Research on carbenes and hydrocarbon radicals continued. The following results are briefly discussed: The rotational spectra of the C_4D radical, C_5D, and C_4D in three vibrationally excited states was measured; rotational spectra of C_2H and C_4H in their lowest bending vibrational states was detected; frequency surveys were begun in two discharges (C_2H_2 and He/C_2H_2, CO, and He) known to produce reactive species; strong absorption lines of SiCC and SiC radical in a discharge through SiH_4, CO, and C_2H_2 were detected. Instrumental development is also reported. 2 figs. (CBS)

31469 (DOE/ER/13933–1) **Quantum state resolved desorption of CO from solid surfaces: Progress report, 15 June 1988–14 June 1989.** Janda, K.C. Pittsburgh Univ., PA (USA). Dept. of Chemistry. May 1989. 13p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER13933. Order Number DE89013570/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The kinetics of desorption of carbon monoxide and hydrogen from a silicon (100) surfaces is described. The technique used in the studies is isothermal laser induced thermal desorption. 3 refs., 3 figs. (CBS)

31470 (DOE/ER/45269–3) **Analytical electron microscopy of catalyst promoters, poisons, and active species: Progress report, [July 1986–September 1988].** Lyman, C.E. Lehigh Univ., Bethlehem, PA (USA). Dept. of Materials Science and Engineering. Nov 1988. 24p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER45269. Order Number DE89013182/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Important discoveries in this period include the first quantitative microanalysis studies of noble metal co-impregnation processes, the first direct elemental imaging of small metal catalyst particles poisoned by sulfur, and the first demonstration that CuO reduction proceeds along different pathways in H_2 reduction and electron beam-induced reduction. Several analytical electron microscopy methods were used to characterize four different catalyst systems. Other work concerned the development of AEM performance tests and design improvements for better catalyst characterization by electron microscopy. Our accomplishments are divided for discussion into five topic areas: (a) quantitative elemental distributions of noble metal catalysts on alumina monoliths, (b) distributions of elemental species on catalyst surfaces, (c) in-situ studies of CuO/ZnO reduction, (d) Fe distributions in FeZSM-5 zeolites, and (e) instrument design criteria for improved AEM analysis of catalysts. 23 refs., 8 figs.

31471 (DOE/ER/45298–2) **Synthesis and properties of novel cluster phases: Progress report ending June 30, 1989.** DiSalvo, F. Jr. Cornell Univ., Ithaca, NY (USA). Dept. of Chemistry. 1989. 2p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER45298. Order Number DE89012779/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report briefly covers the second year of funding. We have determined the mechanism by which Ta_2CS_2 is formed in solid state reactions. The solution chemistry of $MoSe_3$ chains has now been determined. Work on Nb_6I_8·(propylamine)$_6$ continues. (JDL)

31472 (DOE/ER/60517–3) **Energy transformation in molecular electronic systems: Comprehensive progress report, 1986–1989.** Kasha, M. Florida State Univ., Tallahassee, FL (USA). Inst. of Molecular Biophysics. 1 Jun 1989. 15p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER60517. Order Number DE89012340/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Our research focuses on discovering the fundamental issues in proton-transfer and charge-transfer excitations in model systems, with an eye on which molecular systems will serve as the best guide to biological systems. This report addresses an intramolecular proton transfer classification system, proton-transfer potentials, proton-transfer spectroscopy of benzanilides, proton-transfer in aminosalicylates, proton-transfer in lumichrome, development of proton-transfer lasers, and triplet excitation enhancement via proton-transfer tunneling. 6 refs., 2 figs. (CBS)

31473 (LA-UR–89-1684) **High precision isotopic analyses of uranium and plutonium by total sample volatilization and signal integration.** Callis, E.L.; Abernathey, R.M. Los Alamos National Lab., NM (USA). 1989. 21p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890565–3: 11. annual ESARDA symposium on safeguards and nuclear materials management, , Luxembourg, 30 May - 1 jun 1989). Order Number DE89013444/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Techniques have been developed which permit rapid, high-precision analyses of uranium and plutonium by multiple-filament thermal ionization mass spectrometry utilizing a commercial multicollector instrument. The salient feature of the method is volatilization of the entire sample while simultaneously integrating the signal from each isotope, thus virtually eliminating the effects of isotope fractionation in the evaporation process. The method permits the analysis of samples much smaller than required for conventional techniques using Faraday collectors and is expected to have application in the analysis of many elements in addition to uranium and plutonium. Run-to-run reproducibilities of <0.02% (RSD) have been obtained for isotope ratios of uranium and plutonium. 7 refs., 5 figs., 4 tabs.

31474 (PB–89-859946/XAB) **Chemical and biological warfare: defoliants and herbicides. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 142p. Available from NTISPC N01/MF N01.

Supersedes PB–88-863162.

This bibliography contains citations concerning the use of defoliants as chemical warfare agents. The studies relate to effectiveness of such agents and their use in South Vietnam, and government policies relating to use and disposal of defoliants. Included are research studies conducted by the Veterans Administration, and at Edgewood Arsenal and Fort Detrick bearing upon warfare defoliants and exposure of humans to these agents. Other published searches in this series on chemical warfare cover detection and warning, protection, general studies, and biological studies, including chemistry and toxicology. (This updated bibliography contains 252 citations, 25 of which are new entries to the previous edition.)

31475 (SAND–89-0861C) **Issues in shock-induced solid state chemistry.** Graham, R.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890661–8: 3. international symposium on behavior of media under high dynamic pressures, La Grande Motte, France, 5-9 Jun 1989). Order Number DE89010769/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

There has been considerable work over the past few years to study shock-induced solid state chemistry. In the present report, issues raised in the area are reviewed and critical concepts are discussed. The distinctive nature of solid state chemistry compared to liquid and gas phase chemistry is emphasized and material probes

suitable for the study of solids are described. In order for solids to react in times less than one microsecond, unusual processes must be initiated in shock compression. Chief among the unique shock processes is the mixing of reactants by the large kinetic energy of shock-compression pulses. Mixing and fluid-like flow can lead to sufficiently intimate contact between reactants to permit complete chemical reaction in the solid state on the time scale of the experiment. Shock-induced solid state chemistry may be described as an unusually intense mechanochemical process. 24 refs., 2 figs.

31476 Viewing the born model for ion hydration through a microscope. Hirata, F. (Rutgers, The State Univ., New Brunswick, NJ (USA)); Redfern, P.; Levy, R.M. pp. 12 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

The hydration-free energy, energy, and entropy of monovalent ions are calculated using the extended RISM integral equation theory and computer simulations. Plots of these thermodynamic quantities against 1/R, where R is the Lennard-Jones radius, lie on two distinct curves corresponding to cations and anions. This result is attributed to differences in the microscopic structure of solvent surrounding the ions. Charge distribution functions are used to analyze solvent structure. It is found that the modified Born formula proposed by the Latimer et al. gives good agreement with the RISM results for the energy and the free energy, but not for the entropy. A microscopic interpretation of Latimer formula is attempted in light of the statistical mechanical theory.

31477 Theoretical interpretation of the anomalous behavior of some macromolecules. Paul, R. (Univ. of Calgary, Alberta (Canada)); Fritz, O.G.; Chatterjee, R. pp. 9 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Recently, one of the members of this group has observed some unusual properties of rouleaugenic polymer solutions. It was found that the diffusion coefficient of polystyrene spheres in these solutions displayed an expected fall followed by an unexpected rise in values when the radii of these particles are changed. In this paper the authors present some of these experiments and provide a thermodynamic interpretation of the rise in the values of the diffusion coefficient.

31478 Characterization of three-dimensional structures. Randic, M. (Drake Univ., Des Moines, IA (USA)). pp. 8 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). DOE Contract W-7405-ENG-82. (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Molecular descriptors currently used in structure-property-activity studies are based on molecular graphs rather than on a structure as a three-dimensional object. Here the authors suggest a way to amend graph-theoretic invariants with additional geometric information, thereby providing new molecular descriptors for possible use in quantitative structure-activity correlations. In the approach they assume molecular structures embedded on a regular grid. As an illustration they consider first chains of different length embedded on graphite-like lattice. Subsequently, they consider all possible conformations of hexatriene. Although the cases considered here relate to graphite-like lattice, the approach is general and applies to embeddings of molecular on three-dimensional lattices, or, in general, to molecules of arbitrary spatial conformations.

31479 The ethyl radical: Photoionization and theoretical studies. Ruscic, B. (Argonne National Laboratory, Argonne, Illinois 60439(US)); Berkowitz, J.; Curtiss, L. A.; Pople, J. A. *Journal of Chemical Physics (USA),* 91(1): 114-121 (1 Jul 1989). DOE Contract W-31-109-ENG-38.

The ethyl radical has been produced by the $F+C_2H_6$ reaction, and studiedby photoionization mass spectrometry. The adiabatic ionization potential (IP) isfound to be 8.117±0.008 eV. The radical and cation have been studied by the G1level of molecular orbital theory. The calculated adiabatic ionization potentialis 8.06 eV. On the basis of both experiment and theory, it is concluded that thecation in its ground state has a bridged structure. The adiabatic value resolvesa previous inconsistency involving $\Delta H^\circ_f(C_2H_5)$,$\Delta H^\circ_f(C_2H^+_5)$ and IP (C_2H_5). Broadautoionizing structures are observed at higher energy. These features can berationalized as Rydberg states converging to the first excited state $^3A''$calculated to be at 12.05 eV.

31480 High temperature deviations from Rice–Ramsberger–Kassel–Marcus unimolecular rate coefficients expressions. Oref, I. (Department of Chemistry, TechnionIsrael Institute of Technology, Haifa, 32000 Israel(US)); Tardy, D. C. *Journal of Chemical Physics (USA),* 91(1): 205-210 (1 Jul 1989).

The closed form of the solution to the master equation for unimoleculardecomposition is investigated. Exact numerical values of theRice–Ramsberger–Kassel–Marcus unimolecular rate coefficient are calculatedfor the decomposition of cyclobutene and the isomerization of quadricyclane. Acomparison between the approximate strong collision low temperature expressionnow in general use and the high temperature strong collision exact expressionshows that in some cases there are large deviations (~40%) between the valuescalculated from the two expressions. The usage of the exact expression causes ashift of the falloff curves toward the high pressure limit. The larger themolecule, the larger the deviation; the higher the value of E_0 the smallerthe deviation. For $E_0/RT>20$ the approximate expression issufficient. These deviations may be quite important in practical systems such ascombustion and atmospheric chemistry and shock tubes.

31481 Structural and NMR study of the lithiated defect thiospinels $Li_xCu_{0.07}[Ti_2]S_4$ ($0 < x < 2$). James, A.C.W.P. (Univ. of Texas, Austin (USA)); Goodenough, J.B.; Clayden, N.J. *Journal of Solid State Chemistry (USA),* 77(2): 356-365 (Dec 1988). DOE Contract W-31-109-ENG-38.

Oxidative extraction of copper from the normal thiospinel $Cu[Ti_2]S_4$ followed by chemical lithiation of the resulting defect thiospinel enabled the metallic, lithiated defect thiospinels $Li_xCu_{0.07}[Ti_2]S_4$ ($0 < x < 2$) to be prepared with high purity and chemical homogeneity. X-ray and neutron powder diffraction studies of $Li_xCu_{0.07}[Ti_2]S_4$ ($< x < 2$) showed that lithium insertion into $Cu_{0.07}[Ti_2]S_4$ is topotactic and that the inserted lithium occupies only the 16c-octahedral sites of the thiospinel framework at all lithium compositions. Static and MAS ^7Li NMR spectra of $Li_xCu_{0.07}[Ti_2]S_4$ ($O < x < 2$) exhibited a single resonance with a small chemical shift relative to lithium acetate dihydrate at all lithium compositions; the chemical shift increased linearly with increasing lithium content x. The ^7Li NMR spectra showed the onset of quadrupolar line broadening and a Knight-shift anisotropy for $x \geq 0.9$; these effects are probably due to interactions between lithium ions on neighboring edge-sharing 16c sites.

31482 Columnar homoconjugation. Angus, R.O. Jr. (Iowa State Univ., Ames (USA)); Johnson, R.P. *Journal of Organic Chemistry (USA),* 53(2): 314-317 (22 Jan 1988).

Homoconjunctive orbital interactions in columnar cyclic arrays of π bonds are analyzed through a simple perturbation approach and through ab initio calculations. These interactions lead to Hueckel arrays of bonding and antibonding orbitals and should have a net destabilizing effect. Specific compounds (1-3) which engender columnar homoconjugation consist of $n(n \geq 3)$ 1,4-cyclohexadiene units which are connected in a cyclic structure of D_{nh} symmetry. These have been previously referred to as beltenes. Optimized geometries (STO-2G, RHF) are reported for compounds with n = 3-5. Single point 3-21G calculations have been performed at optimized geometries. The double bonds in these columnar structures are predicted to be significantly pyramidalized. Orbital interactions and estimates for the potential stability of columnar structures are discussed. 18 references, 4 figures, 3 tables.

31483 Molecular dynamics simulation of water beween two ideal classical metal walls. Hautman, J. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota

55455(US)); Halley, J. W.; Rhee, Y. *Journal of Chemical Physics (USA),* 91(1): 467-472 (1 Jul 1989).

We have simulated a slab of water with two-dimensional periodic boundaryconditions between two metallic walls. The entire compliment of charges, arisingfrom periodic reproductions and from classical images in the metal, are includedexplicitly by mapping onto a problem with three-dimensional periodicity which ishandled by usual Ewald summation methods. Results are presented for charged anduncharged surfaces, permitting an estimate of the differential capacitancearising from the layer of water near the walls. The estimate is about a factorof 2 smaller than the observed differential capacitance of metal–aqueouselectrolyte interfaces.

31484 Dissolving metal reduction of aceanthrylene and NMR analysis of a rigid, boat-shaped 9,10-dihydroanthracene. Rabideau, P.W. (Indiana Univ., Indianapolis (USA)); Mooney, J.L.; Smith, W.K.; Sygula, A. *Journal of Organic Chemistry (USA),* 53(3): 589-591 (5 Feb 1988).

Aceanthrylene is reduced by sodium/ammonia solution to its 2,6-dihydro derivative (4), which indicates a protonation site in the dianion in contrast to the MNDO-calculated position of highest electron density. It is concluded that monoanion stability must be the prevailing feature. Compound 4 is also reduced by sodium/ammonia to provide 1,9-ethano-9,10-dihydroanthracene, which allowed the first proton NMR study of a rigid, boat-shaped dihydroanthracene. Especially interesting are the long range, five-bond homoallylic couplings between the 9- and 10-positions, and the values measured are 4.7 Hz for $^5J_{9,10}$ (dipseudoaxial) and 1.4 Hz for $^5J_{9,10'}$ (pseudoaxial/pseudoequatorial). The protonation and alkylation of (3-phenylindenyl)lithium is also considered so as to better understand the behavior of the intermediates derived from aceanthrylene. 20 references, 3 tables.

31485 Theoretical studies of the energetics and structures of atomic clusters. Xie, J. (Department of Physics, University of Rhode Island, Kingston, Rhode Island 02881(US)); Northby, J. A.; Freeman, D. L.; Doll, J. D. *Journal of Chemical Physics (USA),* 91(1): 612-619 (1 Jul 1989).

Comparative calculations of the binding energy and structure of relaxedclosed-shell clusters of icosahedral and cuboctahedral point group symmetry arereported. The atoms are presumed to interact via either the Lennard-Jones or theAziz–Chen (HFD–C) pair potential. The IC structure is found to be lower intotal energy for less than 14 shells (10 179 atoms) in the Lennard-Jones caseand for less than 13 shells (8217 atoms) in the HFD–C case. Detailedenergetics are analyzed in order to elucidate the mechanism for the transitionfrom icosahedral to cuboctahedral symmetry.

31486 Thermodynamic Properties of Dioxygen Difluoride (O_2F_2) and Dioxygen Fluoride (O_2F). Lyman, J. L. (Chemical and Laser Sciences Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)). *Journal of Physical and Chemical Reference Data (USA),* 18(2): 799-807 (Apr 1989).

Recent spectroscopic and chemical kinetic studies have provided sufficientdata for construction of reliable thermodynamic tables for both dioxygendifluoride (O_2F_2; Chemical Abstracts Registry Number, 7783-44-0) anddioxygen fluoride (O_2F; Chemical Abstracts Registry Number, 15499-23-7). Thispaper contains those tables for these species in both SI units (0.1 MPa standardstate) and cal K mol units (1.0 atm standard state). The experimental basisincludes three recent assignments of the fundamental vibrational frequencies forO_2F_2, a new set of rotational constants for O_2F, an enthalpy change fordissociation of O_2F, and an updated standard enthalpy of formation forO_2F_2.

31487 Regioselective synthesis of substituted 1-thiohex-2-enopyranosides. Dunkerton, L.V. (Southern Illinois Univ., Carbondale (USA)); Adair, N.K.; Euske, J.M.; Brady, K.T.; Robinson, P.D. *Journal of Organic Chemistry (USA),* 53(4): 845-850 (19 Feb 1988).

A variety of 1-thiohex-2-enopyranosides have been prepared from their corresponding 3-O-methyl- or 3-O-acetylglycals by using trimethylsilyl thiols catalyzed by BF_3 etherate. This method is regioselective for thiolation at C-1 in contrast to the same reaction with thiols which produces C-3 products under thermodynamic control. The stereoselectivity of the reaction depended on the choice of trimethylsily thiol and the leaving group at C-3 of the glycal. [(Trimethylsilyl)thio]benzene gave α-anomers as the only products, whereas (thionacetoxy)trimethylsilane gave more β-anomer products from 3-O-methylglycals than from 3-O-acetylglycals. Examples reported include the synthesis of S-(2'-pyridyl) 2,3,6-trideoxy-4,6-di-O-acetyl-1-thio-α-D-erythro-hex-2-enopyranoside (1), S-phenyl 2,3,6-trideoxy-4-O-methyl-1-thio-α-L-erythro-hex-2-enopyranoside (15), S-acetyl 2,3,6-trideoxy-4-O-methyl-1-thio-β-L-erythro-hex-2-enopyranoside (16), S-acetyl 2,3-dideoxy-4,6-di-O-methyl-1-thio-α,β-D-erythro-hex-2-enopyranosides (17, 18), S-acetyl 2,3-dideoxy-4,6-di-O-acetyl-1-thio-α,β-D-erythro-hex-enopyranosides (19, 20), and S-acetyl 2,3,6-trideoxy-4-O-acetyl-1-thiol-α,β-L-erythro-hex-2-enopyranosides (21,22). 24 references, 3 figures, 2 tables.

31488 Kinetics of the complexation of nickel (II) with 8-hydroxyquinoline in aqueous solution. Li, K.Y. (Lamar Univ., Beaumont, TX (USA)); Smith, L.L. *Separation Science and Technology (USA),* 23(12-13): 1373-1388 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The complexation of nickel ion (II) with 8-Hydroxyquinoline were studied in aqueous solution for the pH range from 4.6 to 5.4 and the temperature range from 15°C to 50°C. The reactions were found to be first-order for the nickel ion concentration and inverse first-order for the hydrogen ion concentration. The formula of the observed rate constant may be expressed as $k_{obs} = k_{+1}K_{HI}\,[N_i^{++}]/[H^+] + k_{-1}$ where k_{+1} and k_{-1} represent the forward and the backward step reaction rate constant, and K_{HI} is the equilibrium constant for 8-hydroxyquinoline in aqueous solution. Both k_{+1} and k_{-1} follow Arrhenius equation behavior and the activation energy is calculated as 8.9 Kcal/g-mole for the forward reaction and 10.63 kCal/g-mole for the backward reaction.

31489 Droplet size characteristics and energy input requirements of emulsions formed using high-intensity-pulsed electric fields. Scott, T.C. (Oak Ridge National Lab., TN (USA)); Sisson, W.G. *Separation Science and Technology (USA),* 23(12,13): 1541-1550 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Experimental methods have been developed to measure droplet size characteristics and energy inputs associated with the rupture of aqueous droplets by high-intensity-pulsed electric fields. The combination of in situ microscope optics and high-speed video cameras allows reliable observation of liquid droplets down to 0.5 μm in size. Videotapes of electric-field-created emulsions reveal that average droplet sizes of less than 5 μm are easily obtained in such systems. Analysis of the energy inputs into the fluids indicates that the electric field method requires less than 1% of the energy required from mechanical agitation to create comparable droplet sizes.

31490 Studies on a membrane reactor. Mohan, K. (Univ. of Cincinnati, OH (USA)); Govind, R. *Separation Science and Technology (USA),* 23(12,13): 1715-1733 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Simulation is used to evaluate the performance of a catalytic reactor with permeable wall (membrane reactor) in shifting the equilibrium of three reversible reactions (cyclohexane dehydrogenation, hydrogen iodide decomposition, and propylene disproportionation). It is found that the preferred choice of cocurrernt or countercurrent operation is dependent on the physical properties and operating conditions. Methods of enhancing conversion are suggested and temperature effects are discussed.

31491 Separation of nitrogen isotopes by displacement band chromatography. Park, W.K. (MRC-MOUND, Miamisburg, OH (USA)); Michaels, E.D. *Separation Science and Technology (USA),* 23(12,13): 1875-1889 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

A study of the separation of ^{14}N and ^{15}N isotopes via displacement band chromatography was conducted using sulfonated styrene-divinylbenzene resins. Starting with a feed solution of 0.5 N

NH_4OH (containing 51% ^{15}N), a band was developed that generated a concentration profile ranging from 11 to 85% ^{15}N. The separative power and HETP (height equivalent to a theoretical plate) were found to be dependent on the resin characteristics (size, crosslinkage) and operating parameters (superficial velocity, concentration). The use of a 7/10-micrometer-size, high performance resin increased the separative power by a factor of 17 and decreased the HETP by a factor of 10, when compared to a 100/200 mesh Dowex 50W-X12 resin under similar process conditions. The HETP could further be reduced by lowering the superficial velocity and/or eluant concentration.

31492 Proposed technique for surface dynamics measurements at high pressure. Gilbert, V.P. (Univ. of Tennessee, Knoxville (USA)); Bienkowski, P.R.; Cochran, H.D. *Separation Science and Technology (USA),* 23(12,13): 1941-1948 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

A new experimental technique is described in which dynamic processes on surfaces - adsorption, desorption, and diffusion - can be monitored directly. The shift in frequency of resonant surface vibrations in a crystal is monitored as a function of time while the surface is exposed to a time dependent driving force. This surface acoustic wave (SAW) device is capable of resolving changes in surface concentrations of less than 1% of a monolayer over time spans of milliseconds or longer, under pressure conditions ranging from ultra-high vacuum to moderate-to-high pressure. The development of the SAW as a monitor for dynamic processes will help meet the instrumental needs for studying the fluid-solid interfaces which control many separation processes.

31493 Theoretical models of thermodynamic properties of supercritical solutions. Cochran, H.D. (Oak Ridge National Lab., TN (USA)); Pfund, D.M.; Lee, L.L. *Separation Science and Technology (USA),* 23(12,13): 2031-2047 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

Several separation processes, including supercritical extraction and supercritical fluid chromatography, take advantage of the striking solubility behavior of supercritical fluids. A general theoretical framework is presented for modeling thermodynamic properties of supercritical solutions based on the theory of Kirkwood and Buff. The theory is expressed in terms of the Kirkwood fluctuation integral from statistical mechanics and permits introduction of appropriate molecular solution approximations. Thus, the solute-solvent interaction may be expressed using a local composition approximation, for example, with an accurate equation of state for the pure solvent. This approach is illustrated for two molecular solution approximations and is compared with solubility and partial molecular volume data.

31494 Review of the factors affecting the stability of solids-stabilized emulsions. Menon, V.B. (Research Triangle Institute, Research Triangle Park, NC (USA)); Wasan, D.T. *Separation Science and Technology (USA),* 23(12,13): 2131-2142 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

This paper discusses the main factors that play an important role in the formation and stabilization of emulsions containing finely divided solids. The influence of contact angle, particle size, particle interactions, and surfactants on emulsion behavior is discussed, and the state of the art in experimental techniques and fundamental research work is described.

31495 Metal-ammonia reduction of α-tetralone. Competition between ring reduction, carbonyl reduction, and dimer formation. Marcinow, Z. (Indiana Univ., Indianapolis (USA)); Rabideau, P.W. *Journal of Organic Chemistry (USA),* 53(9): 2117-2119 (29 Apr 1988).

It is reported that the reaction of α-tetralone with alkali metal in ammonia can produce as many as seven different products including a previously unknown nuclear reduction product. The reaction was found to be very sensitive to reaction conditions. 13 references, 1 table.

31496 Metal-ammonia reduction of triphenylene. Marcinow, Z. (Indiana Univ., Indianapolis (USA)); Sygula, A.; Rabideau, P.W. *Journal of Organic Chemistry (USA),* 53(5): 3603-3606 (22 Jul 1988).

In the reaction of polynuclear aromatic hydrocarbons with alkali metals in liquid ammonia to produce hydroaromatics, it has been found that in certain instances protonation does not occur at the calculated position of highest electron density but rather at a position to produce the most stable monoanion. The isolation of a number of new and interesting hydrocarbons produced by this reaction are reported herein. UV- and NMR-spectral studies were used to determine the structures of the product compounds.

31497 Experimental and theoretical study of the structures and optical rotations of chiral bicyclic ortho esters. Wroblewski, A.E. (Iowa State Univ., Ames (USA)); Applequist, J.; Takaya, A.; Honzatko, R.; Kim, S.S.; Jacobson, R.A.; Reitsma, B.H.; Yeung, E.S.; Verkade, J.G. *Journal of the American Chemical Society (USA),* 110(13): 4144-4150 (22 Jun 1988).

Syntheses are described for three rigid (−)-1-R-2,7,8-trioxabicyclo[3.2.1]octanes (R = H, 1; R = Me, 2; R = Ph, 3) in high enantiomeric purity. The crystal and molecular structure of (−)-3 was determined by X-ray means. A crystal of (−)-3 grown from Et_2O-n-C_6H^{14} belonged to the space group $P2_1$ having cell constants a =\7.8520 (9), b = 10.493 (1), and c = 6.1048 (6) Åand β = 107.02 (1)°. The cell volume was 481.35 (9) $Å^3$ with 2 molecules per unit cell. From the crystallographic data, four refined structural models of 3 were generated, which differed only in their degree of geometric optimization. Whereas model 1 is unrestrained, models 2-4 are increasingly restrained to ideal geometry in order to correct the systematically short bonds associated with an unrestrained refinement. Molar rotations were calculated from classical dipole interaction theory with the structural parameters from the four models of 3 and atom polarizabilities derived earlier. The calculated molar rotations for 3 were correct in sign and insensitive to rotations of the phenyl group about the C-C bond. The differences between the calculated values and the experimental rotation decreased to within a factor of 4 concomitantly with the increased level of geometric optimization of the models. The difference between the theoretical and experimental values is attributable to small uncertainties in atom coordinates and atom polarizabilities.

31498 Effects of solvents, axial ligation, and radical cation formation on the V=O stretching Raman frequency in vanadyl porphyrins: implications for peroxidase intermediates. Su, Y.O. (Princeton Univ., NJ (USA)); Czernuszewicz, R.S.; Miller, L.A.; Spiro, T.G. *Journal of the American Chemical Society (USA),* 110(13): 4150-4157 (22 Jun 1988). DOE Contract AC02-81ER10861.

The systematics of the V=O stretching frequency in vanadyl porphyrins are investigated with resonance Raman (RR) spectroscopy. For a series of solvents the frequency decreases with increasing solvent acceptor number consistent with solvent-induced polarization of the V-O bond. Variations in the solvent dependence are seen for different porphyrins, reflecting different polarization effects on the peripheral substituents. In coordinating solvents a second V-O stretching band, at lower frequency, arises from six-coordinate species. The downshift in ν_{V-O} upon ligation increases with increasing donor strength of the ligand. It is larger for imidazolate than imidazole, and it is especially large for hydroxide; the hydroxide effect is attributed to $OH^- \rightarrow V^{IV}$ π-donation, competing with the oxo ligand for acceptor d orbitals. The RR spectrum of $(VO)OEP^{+\cdot}$ produced by electrochemical oxidation shows porphyrin skeletal mode frequency shifts similar to those seen for other OEP π-cation radicals. The V-O stretching frequency increases 15 cm^{-1} relative to (VO)OEP. These findings are discussed in relation to recent RR data on ferryl porphyrins and ferryl species in home proteins. Differences among these species can be accounted for on the basis of proximal and distal effects.

31499 Oxomanganese(IV) porphyrins identified by resonance Raman and infrared spectroscopy: weak bonds and the stability of the half-filled t_{2g} subshell. Czernuszewicz, R.S. (Princeton Univ., NJ (USA)); Su, Y.O.; Stern, M.K.; Macor, K.A.; Kim, D.; Groves, J.T.; Spiro, T.G. *Journal of the American Chemical Society (USA),* 110(13): 4158-4165 (22 Jun 1988).

The Mn^{IV}-O stretching frequency is identified at 754 cm^{-1} in resonance Raman (RR) and infrared (IR) spectra of Mn^{IV} porphyrins prepared by electrooxidation of $ClMn^{III}TMP$ (TMP = tetramesitylporphyrin), $ClMn^{III}TPP$ (TPP = tetraphenylporphyrin) and $ClMn^{III}OEP$ (OEP = octaethylporphyrin) in CH_3CN containing tetrabutylammonium hydroxide (TBA(OH)). This vibrational band establishes oxo-Mn^{IV} bond formation under these conditions and shows the bond to be anomalously weak. When the oxidation is carried out in CH_2Cl_2 containing TBA(OH), or when $ClMn^{III}TMPyP$ (TMPyP = tetrakis(methylpyridinium)porphyrin) is electrooxidized in aqueous 1 M NaOH, the Mn-O stretching band is seen at 711 cm^{-1}. This band is associated with a trans OH^- adduct, as shown by its anomalous upshift, to 732 cm^{-1}, in D_2O; the lower frequency in H_2O is attributed to interaction with the Mn-O-H bend of the trans OH^- ligand, which is relieved when H is replaced by D. EPR spectra of all these species show strong $g \perp \sim 4.0$ and weak $g \parallel \sim 2.0$ signals characteristics of a high-spin d^3 configuration. The $Mn^{III}TMPyP$ species in 1 M NaOH is shown to be a trans dihydroxide adduct by virtue of a 495-cm^{-1} RR band identified, on the basis of its $H_2{}^{18}O$ and D_2O shifts, as the symmetric Mn-$(OH)_2$ stretch. The M-O stretching frequencies are compared for V^{IV}, Cr^{IV}, Mn^{IV}, and Fe^{IV} porphyrins, and the anomalous weakness of the Mn^{IV}-O bond is attributed to the special stability and low polarizability of the half-filled $t_{2g}{}^3$ subshell. Consequences of this weak bond for manganyl reactivity are discussed.

31500 Effect of fluctuations in state-specific unimolecular rate constants on the pressure dependence of the average unimolecular reaction rate. Miller, W.H. (Lawrence Berkeley Lab., CA (USA)). *Journal of Physical Chemistry (USA),* 92(15): 4261-4263 (28 Jul 1988). DOE Contract AC03-76SF00098.

The standard (i.e., Lindemann mechanism, strong-collision assumption, etc.) treatment of thermal unimolecular reactions expresses the effective, pressure-dependent unimolecular rate constant (usually called k_{uni}) in terms of the average unimolecular rate constant for a given total energy, k(E) (and, more rigorously, for a given total angular momentum). Several experimental and theoretical studies have shown, however, that unimolecular rate constants for individual quantum states (all of essentially the same total energy and angular momentum) can have significant variations about the average rate, i.e., a significant degree of state specificity. This paper examines the effect that these fluctuations have on the effective, pressure-dependent rate, k_{uni}. The general result is that fluctuations reduce the rate, most prominently at high pressures.

31501 Reactions of low-valent transition-metal complexes with hydrogen peroxide. Are they Fenton-like or not? 1. The case of Cu^+_{aq} and Cr^{2+}_{aq}. Masarwa, M. (Ben-Gurion Univ. of the Negev, Beer-Sheva (Israel)); Cohen, H.; Meyerstein, D.; Hickman, D.L.; Bakac, A.; Espenson, J.H. *Journal of the American Chemical Society (USA),* 110(13): 4293-4297 (22 Jun 1988).

A thermodynamic analysis of the Fenton reaction and the Fenton-like reactions points out that their detailed mechanisms involve the formation of a transient complex between the low-valent cation $ML_m{}^n$ and hydrogen peroxide of the type $ML_{m-1}{}^n \times O_2H^-$. This complex might decompose into $ML_m{}^{n+1}$ + ·OH or $ML_m{}^{n+2}$ + H_2O react directly with a substrate. Experimental data from studies in acidified solutions indicate that $(H_2O)_5Cr^{2+} \times O_2H^-$ decomposes into $Cr(H_2O)_6{}^{3+}$ + ·OH in the presence of $\geq$ 0.1 mM ethanol, 2-propanol, and 2-butanol, whereas $(H_2O)_mCu^+ \cdot O_2H^-$ reacts with the alcohols directly. However, in the absence of an organic substrate, the latter complex in acidic solution decomposes into $Cu(H_2O)_n{}^{2+}$ + ·OH. The specific overall reactions rates of Cu^+_{aq} with H_2O_2, $(CH_3)_3COOH$, and $S_2O_8{}^{2-}$ are 4.1 x 10^3, $\sim$ 4 x 10^3, and $\geq$ 1 x 10^7 M^{-1} s^{-1}, respectively.

31502 Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions. McGhee, W.D. (Lawrence Berkeley Lab., CA (USA)); Bergman, R.G. *Journal of the American Chemical Society (USA),* 110(13): 4246-4262 (22 Jun 1988). DOE Contract AC03-76SF00098.

The iridium allyl hydride complex (η^5-C_5Me_5)(η^3-C_3H_5)(H)Ir (2) has been prepared from [(η^5-C_5Me_5)$IrCl_2$]$_2$, and its reaction with arenes and alkanes has been investigated. The hydride reacts with C-H bonds in benzene and cyclopropane in the presence of phosphines L, leading to the phenyl and cyclopropyl complexes (η^5-C_5Me_5)(L)Ir(n-propyl)(R) (3,4, and 5). Irradiation of 2 in the presence of PMe_3 takes a different course, giving the previously uncharacterized (η^5-C_5Me_5)Ir(PMe_3)$_2$ (6). Thermal reaction of 2 in alkane solvents such as n-butane and isobutane, which are capable of β-elimination, leads to products 8a, 8b, and 9 formed by replacement of the allyl group in 2 by a substituted allyl ligand formed by overall dehydrogenation of the alkane. Thermolysis of 2 in the presence of arenes such as n-propylbenzene and cumene leads to more complicated products resulting from intermolecular C-H activation followed by cyclometalation (e.g., 13, 15) and/or dimerization (20). The structure of cyclometalated dimer 20 has been determined by X-ray diffraction. Mechanistic studies, including kinetics, isotope tracer experiments, and intra-versus intermolecular isotope effect determinations, implicate the coordinatively unsaturated species (η^5-C_5Me_5)(η^2-propene)Ir (complex A in Scheme XX) as the initially formed intermediate in the thermal reactions of 1 with alkanes and arenes. Significant differences exist between the behavior of this intermediate (cf. Schemes XIX and XXIII) and that of the closely related phosphine-substituted complex (η^5-C_5Me_5)(PMe_3Ir) studied earlier; possible reasons for these differences are discussed.

31503 High-pressure spectroscopic studies of ferrocene, nickelocene, and ruthenocene. Roginski, R.T. (Univ. of Illinois, Urbana, Champaign (USA)); Shapley, J.R.; Drickamer, H.G. *Journal of Physical Chemistry (USA),* 92(15): 4316-4319 (28 Jul 1988). DOE Contract AC02-76ER01198.

The solid-state infrared spectra (700-1300 cm^{-1}) of ferrocene, nickelocene, and ruthenocene exhibit significant changes with hydrostatic pressure (0-120 kbar). A number of bands show a continuous increase in intensity with increasing pressure; also, several new bands appear in this spectral region at elevated pressures. These changes are discussed in terms of intermolecular interactions between molecules within unit cell, whereby the motions of the molecules are coupled to such an extreme as to impact intensity to vibrational modes that were previously dipole forbidden.

31504 Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene. Roginski, R.T. (Univ. of Illinois, Urbana, Champaign (USA)); Moroz, A.; Hendrickson, D.N.; Drickamer, H.G. *Journal of Physical Chemistry (USA),* 92(15): 4319-4323 (28 Jul 1988). DOE Contract AC02-76ER01198.

The effects of pressure on various d-d transitions for ferrocene, cobaltocenium hexafluorophosphate, and nickelocene in the solid state are presented here. The bands are found to shift in a manner such as to increase the symmetry-imposed splittings between the d orbitals, which is consistent with a qualitative molecular orbital picture. These splittings are found to increase between 2 and 8% in 100 kbar, as compared with 7-15% for simple ionic compounds. The Racah parameter B is almost independent of pressure, in contrast to the results seen for simple ionic compounds. These results are discussed in terms of the large degree of covalency for these compounds.

31505 Guanidyl groups: new metal-binding ligands in biomolecules. Reactions of chloro(2,2':6',2"-terpyridine)platinum(II) with arginine in two cytochromes c and with other guanidyl ligands. Ratilla, E.M.A. (Iowa State Univ., Ames (USA)); Kostic, N.M. *Journal of the American Chemical Society (USA),* 110(13): 4427-4428 (22 Jun 1988). DOE Contract W-7405-ENG-82.

The recognized functions of arginine (Arg) residues in proteins-binding of cofactors and anions-involve electrostatic attraction to the guanidinium cation. Although transition metals are common in metalloproteins and in metal-activated enzymes, their covalent binding to Arg side chain has not been proposed. Indeed, metal-guanidyl complexes are barely known. The precedent reported herein shows that Arg can bind metals, and that inorganic complexes hold promise as heavy-atom and spectroscopic tags for Arg.

31506 Doubly charged gas-phase heteronuclear cluster ions: synthesis and reaction of $LaFe^{2+}$ with small hydrocarbons. Huang, Y. (Purdue Univ., West Lafayette, IN (USA)); Freiser, B.S.

Journal of the American Chemical Society (USA), 110(13): 4434-4435 (22 Jun 1988). DOE Contract FG02-87ER13766.

Recently there has been an intense interest in the physical and chemical properties of small transition metal containing ions in the gas phase. The species that have been studied include monatomic positive ions M^+, negative ions M^-, and homonuclear and heteronuclear cluster ions of different sizes. Contrary to a belief that doubly charged transition metal ions might only undergo charge exchange reactions with small hydrocarbons in the gas phase, recent studies have shown that Ti^{2+} and Nb^{2+} undergo a variety of interesting reactions with these compounds. A natural extension of this work is the study of double charged cluster ions. Here the authors report the in situ synthesis of $LeFe^{2+}$ and its reactivity with a few small hydrocarbons in the gas phase.

31507 Studies on the biosynthesis of the m-C_7N unit in the antibiotics manumycin and asukamycin. Beale, J.M. (Ohio State Univ., Columbus (USA)); Herrold, R.E.; Floss, H.G.; Thiericke, R.; Zeeck, A.; Nakagawa, A.; Omura, S. *Journal of the American Chemical Society (USA),* 110(13): 4435-4437 (22 Jun 1988).

The manumycin group of antibiotics, represented by manumycin (1), asukamycin (2), colabomycin, U-62,162, and U-56,407, contains as a central structural element a multifunctional m-C_7N unit. This moiety, consisting of a six-membered ring carrying one carbon and one nitrogen atom in a meta disposition, is ubiquitous in nature in a variety of forms. The m-C_7N unit is most commonly quininoid as exemplified by the rifamycins, mitomycins, and ansamitocins, or aromatic as in the case of pactamycin. In these antibiotics, its biogenesis has been demonstrated to proceed by a branch of the shikimic acid pathway, ultimately via 3-amino-5-hydroxybenzoic acid (AHBA) or 3-aminobenzoic acid (ABA). Other forms of the m-C_7N unit are found in the valienamine moiety of validamycin and acarbose and in the antibiotic kinamycin; in these cases it has been shown that the unit derives from intermediates of the pentose phosphate pathway and from acetate, respectively. The structural and stereochemical uniqueness observed in 1 (4R) and 2 (4S) led the authors to study the biosynthesis of these antibiotics in parallel. In this communication they present confirming a new biochemical pathway leading to the m-C_7N unit.

31508 Probing metal cluster formation in NaY zeolite by ^{129}Xe NMR. Chmelka, B.F. (Univ. of California, Berkeley (USA)); Ryoo, R.; Liu, S.B.; de Menorval, L.C.; Radke, C.J.; Petersen, E.E.; Pines, A. *Journal of the American Chemical Society (USA),* 110(13): 4465-4467 (22 Jun 1988). DOE Contract AC03-76SF00098.

The performance of zeolite-supported metal catalysts is known to depend upon preparatory treatments. Homogeneous and reproducible metal dispersion can be achieved only through careful control of calcination and reduction conditions, since migration and agglomeration of cluster precursors can occur with subsequent loss of catalytic activity. In spite of considerable research, the transformations undergone by metal guest species during calcination and reduction have not been established, primarily due to difficulties in characterizing chemical intermediates which exist as cluster precursors. By using the ^{129}Xe NMR spectroscopy technique pioneered by Fraissard and co-workers and applied to recent advantage by the authors and others, they gain insight into the detailed chemistry of metal-zeolite catalyst preparation. They report for the first time changes in the chemical environment of NaY-supported platinum guest species by monitoring shifts in the ^{129}Xe resonance signal induced by different chemical and thermal treatments.

31509 Organized monolayers of polycyclic aromatic quinones. Kenny, P.W. (Univ. of Minnesota, Minneapolis (USA)); Miller, L.L.; Rak, S.F.; Jozefiak, T.H.; Christopfel, W.C.; Kim, J.H.; Uphaus, R.A. *Journal of the American Chemical Society (USA),* 110(13): 4445-4446 (22 Jun 1988). DOE Contract FG02-84ER13261.

Organized monolayers are of interest for a variety of scientific and technological applications. These systems could, for example, afford the realization of long envisioned molecular electronic devices by providing structures with appropriate optical, electrical or redox characteristics. Studies of conventional amphiphiles (structural partitioning of hydrophilic/hydrophobic properties) have dominated the field of monolayer science, but modern synthetic techniques might provide a greatly increased range of materials for monolayer formation. In this context, the present study evolved from the development of a synthetic method for the production of some unusual, soluble polyacenequinone derivatives. A particularly interesting example is 1, a rod-like molecule 52.8 Å long. The authors have determined surface isotherms of 1 and similar compounds report that they form organized monolayers at the air-water interface.

31510 Adiabaticity criteria for outer-sphere bimolecular electron-transfer reactions. Onuchic, J.N. (Universidade de Sao Paulo, Sao Carlos (Brazil)); Beratan, D.N. *Journal of Physical Chemistry (USA),* 92(17): 4817-4820 (25 Aug 1988).

A model is presented for outer-sphere bimolecular electron-transfer reactions which is correct in the adiabatic, nonadiabatic, and intermediate dynamical regimes for an overdamped solvent coordinate. From this model the authors deduce the conditions for the transfer to be adiabatic or nonadiabatic. Evidence for the two regimes exists in the experimental literature, so this work will provide guidance for mapping out the transition between these regimes. The time-scale separations needed to adequately describe the process as an average over (distant dependent) unimolecular rates are described.

31511 Glassy carbons from poly(furfuryl alcohol) copolymers: structural studies by high-resolution solid-state NMR techniques. Eckert, H. (Univ. of California, Santa Barbara (USA)); Levendis, Y.A.; Flagan, R.C. *Journal of Physical Chemistry (USA),* 92(17): 5011-5019 (25 Aug 1988). DOE Contract FG22-84PC70775.

The chemical structure of glass carbon particles produced from poly(furfuryl alcohol) copolymers is studied by ^{13}C cross-polarization/magic-angle spinning (CP-MAS) NMR and high-speed ^{1}H MAS NMR. In agreement with earlier proposals, ^{13}C NMR spectra confirm the buildup of a highly unsaturated system at the expense of furan rings and aliphatic carbon atoms, and upon heating to 800 K this conversion is essentially complete. Successive carbonization by air oxidation or pyrolysis at temperatures up to 1600 K is reflected in a gradual decrease of the ^{13}C chemical shift from ca. 130 to 115 ppm versus tetramethylsilane. ^{1}H MAS NMR is used to detect and quantitate the amount of residual C-bonded hydrogen species at various stages of the carbonization process. In addition, these spectra show intense, narrow resonances due to sorbed H_2O molecules, which resonate over a wide range of chemical shifts (between 2.5 and −8 ppm versus tetramethylsilane). In analogy with effects observed by Tabony and co-workers for molecules adsorbed above the basal plane of graphite, the upfield shifts observed for water sorbed in the glassy carbons of the present study are attributed to the large susceptibility anisotropy of submicroscopically ordered, turbostratic, or partially graphitized regions of the samples. The extent of this ordering is inversely correlated with the absolute content of residual C-bonded hydrogen species and depends mainly on the temperature of pyrolysis, whereas the oxygen content of the heating atmosphere and the composition of the initial polymeric material appear to be of secondary importance. The results suggest that sorbed H_2O molecules can function as sensitive NMR chemical shift probes for the initial stages of crystallization processes in glassy carbons.

31512 Kinetics of the reaction of NO_3 with HO_2. Hall, I.W. (Univ. of Oxford (England)); Wayne, R.P.; Cox, R.A.; Jenkin, M.E.; Hayman, G.D. *Journal of Physical Chemistry (USA),* 92(17): 5049-5054 (25 Aug 1988).

The kinetics of the title reaction were investigated by molecular modulation-UV/visible absorption spectroscopy. NO_3 and HO_2 were generated by modulated photolysis of Cl_2 in the presence of $ClONO_2$, H_2, and O_2 in a flow system at 1 atm pressure and their concentration modulations monitored by time-resolved absorption at 662 and 220 nm, respectively. The rate coefficient for the overall reaction $NO_3 + HO_2 \rightarrow$ products, k_4, was determined by computer fitting to data at five temperatures in the range 263-338 K and was given by $k_4 = 2.3_{-1.8}^{+2.8} \times 10^{-12} \exp(+(170 \pm 270)/T)$ cm^3 molecule^{-1} s^{-1}. An upper limit of 0.6 for the ratio k_{4b}/k at 283 K, where k_{4b} is the rate constant for the reaction channel $NO_3 + HO_2 \rightarrow OH + NO_2 + O_2$, was established by measurement of OH by modulated resonance absorption. The alternate channel, 4a, is assumed to produce HNO_3, i.e., $NO_3 + HO_2 \rightarrow HNO_3 + O_2$.

31513 Resonance Raman studies of substituent effects on the electronic structure of phenoxyl radicals. Tripathi, G.N.R. (Univ. of Notre Dame, IN (USA)); Schuler, R.H. *Journal of Physical Chemistry (USA),* 92(18): 5129-5133 (8 Sep 1988).

The resonance Raman spectra of para-substituted phenoxyl radicals ($XC_6H_4O\cdot$; X = CH_3, F, Cl, Br, OCH_3, OH) observed by time-resolved techniques in aqueous medium, exhibit a wide variation in spectral features intermediate between phenoxyl and *p*-benzosemiquinone anion radicals. The ν_{7a} (CO stretch) vibration, which is strongly enhanced on Raman excitation in resonance with the electronic transition in the ≈ 400-nm region, appears in a narrow frequency range 1511-1518 cm^{-1}, indicating that the CO bond in the ground electronic state of these radicals is very similar to that of phenoxyl (ν_{7a} at 1505 cm^{-1}). The relative intensities of the ν_{8a} bands (CC stretch), observed in the 1552-1613-cm^{-1} region, change dramatically with the electronic properties of the substituent group. This vibration, which is not apparent in the Raman spectrum of phenoxyl excited at 400 nm, is observed with an intensity comparable to the of the ν_{7a} vibration in the *p*-bromo, *p*-methoxy, and *p*-hydroxy derivatives. The Raman intensities show that the electronic structures in the excited states of the *p*-methoxy and *p*-fluoro-, and p-chloro-substituted radicals are essentially phenoxyl like, while the structures in p-methoxy and p-hydroxy derivatives approach that of *p*-benzosemiquinone anion radical as a result of strong interaction of the substituent's $p\pi$ electrons with the phenoxyl π system. The excited state of *p*-bromophenoxyl radical represents an important intermediate case. The resonance enhancement of the ν_{9a} CH bending vibration, observed at ≈ 1160 cm^{-1}, parallels that of the ν_{8a} phenyl mode and provides an important diagnostic for assignment of the latter vibration.

31514 Reactions of ethanethiol on Mo(110): formation and decomposition of a surface alkyl thiolate. Roberts, J.T. (Harvard Univ., Cambridge, MA (USA)); Friend, C.M. *Journal of Physical Chemistry (USA),* 92(18): 5205-5213 (8 Sep 1988). DOE Contract FG02-84ER13289.

The reactions of ethanethiol (C_2H_5SH) on Mo(110) under ultra-high vacuum have been investigated by temperature-programmed reaction, X-ray photoelectron, and high-resolution electron energy loss spectroscopies. Electron energy loss spectroscopy indicates that the S-H bond in ethanethiol dissociates below 120 K to form a surface ethyl thiolate (C_2H_5S). At low coverages the ethyl thiolate decomposes to atomic carbon, atomic sulfur, and gaseous H_2, with decomposition complete below 350 K. At high coverages, the surface thiolate decomposes during temperature-programmed reaction via three competing pathways: hydrogenolysis at 300 K to gaseous ethane, dehydrogenation at 340 K to gaseous ethylene, and decomposition to surface carbon, surface sulfur, and gaseous dihydrogen. Notably, the presence of surface atomic sulfur is not necessary for selective formation on clean Mo(110); the thiolate remains intact up to the temperature of hydrogenolysis onset. The last pathway proceeds via a hydrocarbon fragment(s) which decomposes at 570 K to gaseous H_2 and atomic carbon. At saturation, ~ 75% of all irreversibly chemisorbed ethanethiol forms gaseous hydrocarbons. The coverage-dependent kinetics for ethanethiol decomposition are discussed in terms of electronic and site-blocking effects.

31515 Kinetics of CO oxidation on single-crystal Pd, Pt, and Ir. Berlowitz, P.J. (Sandia National Labs., Albuquerque, NM (USA)); Peden, C.H.F.; Goodman, D.W. *Journal of Physical Chemistry (USA),* 92(18): 5213-5221 (8 Sep 1988). DOE Contract AC04-76DP00789.

The activity of Pt(100), Pd(110), Ir(111), and Ir(110) single-crystal catalysts for CO oxidation has been studied as a function of temperature and partial pressure of O_2 and CO in a high-pressure reactor-ultra-high-vacuum surface analysis apparatus over the temperature range 425-725 K and pressure range 0.1-600 Torr. The specific rates and the partial pressure dependencies determined for the single crystals are in excellent agreement with results obtained previously for high surface area supported catalysts, demonstrating the structure insensitivity of this reaction. The single-crystal catalysts exhibit simple Arrhenius behavior over most of the temperature range studied, and the observed activation energies lie between 22 and 33 kcal/mol, close to the desorption energy of CO from these surfaces. These results are consistent with the generally accepted model in which the surface is primarily covered with CO and the reaction rate is controlled by the desorption of CO. Deviation from Arrhenius behavior below 500 K for Pt is interpreted as a change in the reaction mechanism. Under highly oxidizing conditions surfaces of both Pd and Ir show negative-order dependence on O_2 partial pressure, indicating the presence of a strongly bound oxygen species. The oxygen species was similar to surface oxide formed by deliberate oxidation and could be detected as CO_2 desorbing at high temperatures in postreaction temperature-programmed desorption. Oxide formed by oxidation of the Pd and Ir samples prior to high-pressure reaction was only stable at 475 K on Pd(110) in an 11:1 O_2:CO mixture and to 500 K on Ir(111) in an 80:1 O_2CO:CO mixture. Deliberate oxidation resulted in a rate decrease but did not affect the activation energy significantly, indicating that the oxide served merely as a simple site blocker.

31516 Carbonaceous solids as a model for adsorption by dispersion forces. Arnett, E.M. (Duke Univ., Durham, NC (USA)); Hutchinson, B.J.; Healy, M.H. *Journal of the American Chemical Society (USA),* 110(16): 5255-5260 (3 Aug 1988). DOE Contract FG22-85PC80521.

Heats of adsorption of many liquids of widely varying structure are reported on several carbonaceous solids: graphite, anthracite coal, Ambersorb XE-348, and two graphitized carbon blacks, Carbopack B and F. Heats of adsorption on the two graphitized carbon black samples correlate closely with the polarizabilities of the adsorbate and the number of main group atoms in the molecules as might be expected for dispersion force interactions; there is no relationship to the basicities of the adsorbates. Except for the two graphitized carbon black samples, Carbopack B and F, correlation between the various type of carbonaceous solids is poor. 39 references, 6 figures, 3 tables.

31517 Stark effect on dynamics and spectroscopy of isolated molecules. Lin, S.H. (Arizona State Univ., Tempe (USA)); Boeglin, A.; Dai, H.L.; Schlag, E.W. *Journal of Physical Chemistry (USA),* 92(19): 5398-5404 (22 Sep 1988). DOE Contract FG02-86ER13584.

In this paper, the authors report the density matrix treatment of the Stark effect on fluorescence spectra and dynamics of isolated excited molecules. They also present some experimental results on the Stark level crossing spectroscopy of formaldehyde. Some numerical calculations are carried out to demonstrate the theoretical results.

31518 Characterization of interstitial hydrogen within metal clusters in $Zr_6Cl_{12}H$ and $ZrClO_xH_y$ by solid-state nuclear magnetic resonance. Chu, P.J. (Iowa State Univ., Ames (USA)); Ziebarth, R.P.; Corbett, J.D.; Gerstein, B.C. *Journal of the American Chemical Society (USA),* 110(16): 5324-5329 (3 Aug 1988). DOE Contract W-7405-ENG-82.

Solid-state NMR studies of hydrogen have been performed on samples of the cluster compound $Zr_6Cl_{12}H$ that contained discernible amounts of the layered compound $ZrClO_xH_y$ ($x + y \leq 1$). The hydrogen in $Zr_6Cl_{12}H$ resonates at 600 ppm upfield from $H_2O(1)$ at 298 K and shows a strong Curie-Weiss paramagnetic shift with temperature but no change in line width, consistent with hydrogen located within an odd-electron and paramagnetic $Zr_6Cl_{12}H$ cluster. Total suppression of this resonance under MREV-8 pulse decoupling indicates that the hydridic species therein experiences random motion on a comparable time scale, in accord with the oversized Zr_6 metal cluster cavity available. These results are consistent with many other observations on other interstitial atoms in Zr_6 octahedral clusters and with the strong correlation of yield with the presence of H_2 in earlier syntheses of several Zr_6Cl_{12} phases. The second hydrogen species observed exhibits a broad temperature-independent resonance with center of mass at -5.0 ppm. A variety of nuclear spin dynamic measurements indicate that the primary contributions to this signal come from pairs of hydride with $\bar{d}$(H-H) = 2.5 ± 0.2 Å, and each of these protons interacts to a lesser degree with one or more chlorine atoms at a $\bar{d}$(H-Cl) ≥ 2.7 Å. These parameters and the orientation of the principal axis of the H-H dipole interaction with respect to the shift tensor agree well with the known structure of $ZrClO_xH_y$. 34 references, 8 figures, 1 table.

31519 Spectroscopic mapping of the OH-Ar van der Waals potential. Berry, M.T. (Univ. of Pennsylvania, Philadelphia (USA));

Brustein, M.R.; Adamo, J.R.; Lester, M.I. *Journal of Physical Chemistry (USA),* 92(20): 5551-5553 (6 Oct 1988).

Fluorescence excitation spectra of OH-Ar van der Waals (vdW) complexes are observed in the spectral region about the OH $A^2\Sigma^+(v'=0)$-$X^2\Pi_{3/2}(v'=0)$ transition. A vibrational progression, consisting of seven elements with similar rotational structure, is assigned to an OH-Ar vdW stretching mode in the excited state. The last member of the progression a lower limit for the OH-Ar binding energy $D_0(v'=0)$ of 521 cm^{-1}. An estimate for the ground-state binding energy $D_0(v'=0)$ of $\geq$ 24 cm^{-1} is obtained from the spectral shift of the vdW vibrational feature to free OH. A comparison is made with an analogous low-frequency vibrational mode previously reported upon electronic excitation of OH in an Ar matrix.

31520 Electrochemical and Raman characterization of molecular recognition sites in self-assembled monolayers. Kim, J.H. (Univ. of Nebraska, Lincoln (USA)); Cotton, T.M.; Uphaus, R.A. *Journal of Physical Chemistry (USA),* 92(20): 5575-5578 (6 Oct 1988). DOE Contract FG02-84ER13261.

Contour-specific sites, produced by silanized monolayers, were shown to possess a pronounced capacity for recognition of a specific molecular species if this species was also present during the original monolayer formation. The preselected species (or template compound) can be subsequently reincorporated into the skeletonized monolayer. The topospecific character of the sites was evident by the extent of reconstitution of the original systems upon reexposure to the template molecules and by the rejection of dissimilar species. The fractional surface occupied by sites was estimated by electrochemical and surface-enhanced resonance Raman measurements. Sites accepting several related porphyrins were produced on glass, tin oxide coated glass, and silver.

31521 Local structure evaluation in solid organophosphorus compound by double cross polarization carbon-13 nuclear magnetic resonance spectroscopy. Hagaman, E.W. (Oak Ridge National Lab., TN (USA)). *Journal of the American Chemical Society (USA),* 110(16): 5594-5595 (3 Aug 1988). DOE Contract AC05-84OR21400.

A ^1H - ^{13}C - ^{31}P double cross polarization (DCP)/MAS ^{13}C NMR method using the direct dipolar interaction between isolated ^{13}C - ^{31}P spin pairs is described here. The method can be used in an organic solid to identify the subsets of carbon within a spherical volume element of 0.4 nm radius centered on the ^{31}P atom. Further delineation of the chemical shift-labeled carbons is provided by their ^{31}P - ^{13}C cross polarization rates which encode ^{31}P -^{13}C internuclear distances. 6 references, 2 figures.

31522 Vibrational spectra and normal-coordinate analysis of tris(bipyridine)ruthenium(II). Mallick, P.K. (Marquette Univ., Milwaukee, WI (USA)); Danzer, G.D.; Strommen, D.P.; Kincaid, J.R. *Journal of Physical Chemistry (USA),* 92(20): 5628-5634 (6 Oct 1988).

The infrared and resonance Raman spectra of the tris(bipyridine)ruthenium(II) complex and several of its deuteriated analogues are reported: specifically, those of the complexes of 3,3'-dideuterio-2,2'-bipyridine, 6,6'-dideuterio-2,2'-bipyridine, and perdeuterio-2,2'-bipyridine. Multiple excitation lines are employed to obtain the resonance Raman spectra to facilitate observation of all A_1 fundamental vibrations associated with the ligand framework. Normal-coordinate calculations are carried out employing a systematic procedure based on a modified valence force field that is comparable to those used previously for aromatic molecules. The resultant (30-force constant) field reproduced observed frequencies with an average error or $\approx$ 1.5%.

31523 Relative and kinetic properties of carbon monoxide and carbon dioxide on a graphite surface. Marchon, B. (Lawrence Berkeley Lab., CA (USA)); Tysoe, W.T.; Carrazza, J.; Heinemann, H.; Somorjai, G.A. *Journal of Physical Chemistry (USA),* 92(20): 5744-5849 (6 Oct 1988). DOE Contract AC03-76SF00098.

Temperature-programmed desorption (TPD) results after chemisorption of carbon monoxide (CO) and carbon dioxide (CO_2) on polycrystalline graphite are presented. CO adsorbs onto graphite with a very low sticking coefficient. After CO chemisorption CO (mass 28 amu) desorbs in two temperature regions, between 400 and 700 K and between 1000 and 1300 K, and CO_2 (mass 44 amu) desorbs below 950 K. The intensity of the CO_2 signal is less than 1 order of magnitude lower than the CO intensity. After CO_2 adsorption the major desorption product is CO at high temperatures (1000 < T (K) < 1300), whereas a small amount of CO_2 desorbs around 450 K. The adsorption of $C^{16}O_2$ and $C^{18}O_2$ mixture leads to a nearly total oxygen scrambling of the CO_2 desorbed. A mechanism for CO and CO_2 interconversion on the graphite surface is presented in terms of surface oxide species, mainly lactones and semiquinones, and their relative stability. Assignments of the TPD features are proposed accordingly. Reaction studies on the CO_2 gasification of clean graphite and the CO disproportionation (Boudouard reaction) have been performed. A good agreement is found between the activation energies obtained and the desorption energies calculated from the analysis of the TPD results.

31524 Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces. Lunt, S.R. (Stanford Univ., CA (USA)); Casagrande, L.G.; Tufts, B.J.; Lewis, N.S. *Journal of Physical Chemistry (USA),* 92(20): 5766-5770 (6 Oct 1988).

Current-voltage and spectral response properties were determined for polycrystalline n-GaAs photoanodes in contact with aqueous KOH-$Se^{-2/-}$ and nonaqueous CH_3CN-ferrocene$^{+/0}$-$LiClO_4$ electrolytes. The n-GaAs/KOH-$Se^{-/2-}$ system initially exhibited poor junction behavior, but chemisorption of Ru^{III}, Rh^{III}, Ir^{III}, Co^{III}, or Os^{III} ions onto the GaAs photoanode was found to yield improved I-V properties. The trend in I-V improvement correlated with improved electrocatalysis of Se^{2-} oxidation at p-GaAs, N^+-GaAs, and In_2O_3 electrode surfaces. The n-GaAs/CH_3CH system displayed excellent junction behavior and did not respond to metal chemisorption treatments. These results are consistent with the metal-ion-induced improvements being predominantly due to electrocatalytic effects.

31525 C-H insertion and π-complex formation reactions of (η^5-C_5Me_5)(PMe_3)Ir with ethylene: an intra- and intermolecular isotope effect study. Stoutland, P.O. (Lawrence Berkeley National Lab., CA (USA)); Bergman, R.G. *Journal of the American Chemical Society (USA),* 110(17): 5732-5744 (17 Aug 1988). DOE Contract AC03-76SF00098.

Thermolysis of the iridium cyclohexyl hydride (η^5-Me_5C_5)(PMe_3)Ir(C_6H_{11})(H) at 130-160°C in cyclohexane in the presence of ethylene results in formation of the vinyl hydride (η^5-Me_5C_5)(PMe_3)Ir(HC $=CH_2$)(H) (1) and the π-complex (η_5-Me_5C_5)(PMe_3)Ir($H_2C=CH_2$) (2) in a ratio of 2:1. Thermolysis of 1 in cyclohexane or benzene above 180°C results in quantitative conversion to 2. Thermolysis of (η_5-Me_5C_5)PMe_3Ir(C_6H_{11})(H) in the presence of ethylene-d_2 results in insertion into both the C-H and the C-D bonds and allows determination of an intramolecular isotope effect: $k_H/k_D = 1.18 \pm 0.03$. Competition experiments involving ethylene and ethylene-d_4 allow determination of an intermolecular isotope effect for insertion into a C-H(D) bond: $k_H/k_D = 1.49 \pm 0.08$. The intermolecular isotope effect for formation of 2 was found to be 0.82 ± 0.05. The different intra- and intermolecular isotope effects for C-H insertion require an intermediate different from the π-complex 2 on the reaction pathway leading to 1. Possible structures for this species are discussed. 44 references, 9 figures, 8 tables.

31526 Evaporation from small particles. Klots, C.E. (Oak Ridge National Lab., TN (USA)). *Journal of Physical Chemistry (USA),* 92(21): 5864-5868 (20 Oct 1988). DOE Contract AC05-84OR21400.

van der Waals molecules as prepared in the laboratory are often found to be evaporating. Recent work has shown, sometimes by fiat, sometimes by calculation, that this can actually serve to characterize them precisely. The present article recapitulates these developments, establishes their roots in unimolecular reaction theory, and clarifies their limitations. Applications in a number of laboratory settings are noted.

31527 Single-pulse Raman scattering study of triaminotrinitrobenzene under shock compression. Trott, W.M. (Sandia National Labs., Albuquerque, NM (USA)); Renlund, A.M. *Journal of Physical Chemistry (USA),* 92(21): 5921-5925 (20 Oct 1988). DOE Contract AC04-76DP00789.

Pulsed-laser-excited Raman scattering methods have been used to examine the dynamic molecular-level response of an explosive molecule (triaminotrinitrobenzene, TATB) to sustained shock loading at a fused silica window interface. The anomalous behavior of Raman modes associated with nitro groups in the molecule (the 881-cm^{-1} NO_2 deformation mode, the 1146 cm^{-1} symmetric C-NO_s stretching mode, and the 1170-cm^{-1} totally symmetric NO_2 stretching mode) is compared to results obtained under static high pressure. The shock compression data indicate that elevated temperatures act to restrain pressure-enhanced coupling of NO_2 and NH_2 groups in the molecule. Differences in the spectra obtained under static and dynamic high-pressure conditions are discussed in relation to the known insensitivity of TATB to shock initiation.

31528 Temperature dependence of the rate constants of the reactions of OH radicals with C_2H_2 and C_2D_2 at 1 atm in Ar and from 333 to 1273 K. Liu, A. (Argonne National Lab., IL (USA)); Mulac, W.A.; Jonah, C.D. *Journal of Physical Chemistry (USA),* 92(21): 5942-5945 (20 Oct 1988).

The absolute rate constants for the gas-phase reactions of OH + C_2H_2 and OH + C_2D_2 were measured at a total pressure of 1 atm in argon buffer gas from 333 to 1273 K by using the pulse radiolysis technique. The predominant reactions were found to change from the addition reaction at lower temperatures to the H-atom abstraction reaction at higher temperatures. The kinetic isotope effect of k(H)/k(D) was $\sim$ 1 below 393 K, $<$ 1 from 393 to 1073 K, and $>$ 1 above 1073 K. From the experimental data of this work and the previous investigations, the second-order constant for addition reaction could be expressed as $8.5 \times 10^{-12} e^{(-1400 \pm 60)/RT}$ cm^3 $molecule^{-1}$ s^{-1} and for H-atom abstraction reaction as $4.5 \times 10^{-11} e^{(-10.500 \pm 3100)/RT}$ cm^3 $molecule^{-1}$ s^{-1}. The indicated error limit in the Arrhenius activation energy is 1 standard deviation of the least-squares analysis.

31529 CO isotopic exchange reaction over Rh/Al_2O_3: nondissociative exchange on metallic Rh sites. Panayotov, D. (Univ. of Pittsburgh, PA (USA)); Basu, P.; Yates, J.T. Jr. *Journal of Physical Chemistry (USA),* 92(21): 6066-6073 (20 Oct 1988).

The isotopic exchange reaction $^{12}C^{18}O + {}^{13}C^{16}O \rightarrow {}^{12}C^{16}O + {}^{13}C^{18}O$ has been studied over alumina-supported rhodium catalysts between 300 and 470 K. For a 2.2 wt % Rh/Al_2O_3 catalyst containing both metallic Rh_x^0 sites and Rh^I sites, the onset of the CO isotopic exchange reaction is observed at 373 K, and an activation energy of 10.8 kcal$\times$$mol^{-1}$ is estimated. In the same temperature range, no CO disproportionation/dissociation reactions are observed. The rate of isotopic exchange per Rh site over 0.2% Rh/Al_2O_3 is found to be slower by a factor of 7 than that over 2.2% Rh/Al_2O_3, due to the low relative population of metallic Rh sites compared to Rh^I sites on the 0.2% Rh/Al_2O_3 surfaces. It is proposed that the CO isotopic exchange proceeds via a nondissociative mechanism on the metallic Rh sites of the Rh catalysts and that the exchange reaction will not occur on Rh^I sites. Mass spectrometric, chemisorption, and IR spectroscopic measurements have been employed.

31530 Influence of swelling on reaction efficiency in intercalated clay minerals. Politowicz, P.A. (Australian National Univ., Canberra); Kozak, J.J. *Journal of Physical Chemistry (USA),* 92(21): 6078-6081 (20 Oct 1988).

A lattice model is designed to determine the extent which the efficiency of reaction between a fixed target molecule and a diffusing coreactant is affected when the interlamellar space separating the atomic layers defining a smectite-type clay is expanded (or swollen). The authors consider partially ordered layer lattices of hexagonal symmetry, and for the case where the target molecule is positioned in the basal lattice at the centrosymmetric site exact numerical solution of the underlying stochastic problem shows that in the limit of large planar arrays the reaction efficiency (as calibrated by the mean walklength (n) of the diffusing coreactant) decreases by a factor of $\approx$ 1.7 for a (stacked) two-layer hexagonal structure and by $\approx$ 2.4 for a three-layer structure. The role of initial conditions and system size is explored, and the exponential character of the decay is quantified.

31531 Electronic excitation transport in core antennae of enriched photosystem I particles from spinach chloroplasts. Causgrove, T.P. (Iowa State Univ., Ames (USA)); Yang, S.; Struve, W.S. *Journal of Physical Chemistry (USA),* 92(21): 6121-6124 (20 Oct 1988). DOE Contract W-7405-ENG-82.

The polarized photobleaching recovery of PSI-60 particles enriched in iron-sulfur protein and P700 was monitored with $\approx$ 2-ps resolution at 665, 670, 675, and 681 nm. Considerable residual anisotropy appears at long times, proving that local ordering exists in the Chl a-protein core antenna of PSI-60. At these four wavelengths, the polarization decays with mean lifetimes between 2.9 and 6.6 ps. This slow time scale suggests that the depolarization accompanies electronic excitation transport between clusters of Chl a chromophores rather than between individual nearest-neighbor chromophores.

31532 Ternary mutual diffusion coefficients of $NaCl-SrCl_2-H_2O$ at 25°C. 2. Total concentrations of 2.0 and 3.0 mol$\times$$dm^{-3}$. Rard, J.A. (Lawrence Livermore Lab., CA (USA)); Miller, D.G. *Journal of Physical Chemistry (USA),* 92(21): 6133-6140 (20 Oct 1988). DOE Contract W-7405-ENG-48.

Mutual diffusion coefficients were measured for aqueous $NaCl-SrCl_2$ mixtures at 25°C by using free-diffusion Rayleigh interferometry. These mixtures were total molarities of 2.0 and 3.0 mol$\times$$dm^{-3}$ with molarity fractions of 2/3, 1/2, and 1/3, the results complement the authors earlier data at 0.5 and 1.0 mol$\times$$dm^{-3}$. At a constant molarity ratio, the NaCl main-term coefficient decreases regularly by 19-36% with increasing concentration, in contrast, the $SrCl_2$ main-term coefficient is relatively constant, with 18% or less variation with concentration. The $SrCl_2$ cross-term coefficient is 7-23% of its corresponding main-term coefficient, whereas the NaCl cross-term coefficient varies from 8% to 73% of its corresponding main-term coefficient. Clearly, coupled diffusion is very important for these systems. Various estimation procedures were considered, including variations using the Nernst-Hartley equations and estimates from the corresponding binary solutions. None of these methods, for which sufficient auxiliary data are available, gave reliable estimates of diffusion coefficients for mixtures. At a total molarity of 3.0 mol$\times$$dm^{-3}$ and molarity fractions of 1/2 and 1/3 NaCl, experiments with the $SrCl_2$ $\Delta c \approx 0$ are convectively unstable with regard to fingering at the center of the boundary. Density data were also measured for the above systems.

31533 Experimental link between the ^{13}C NMR chemical shift of carbonyl carbons and the energy shifts observed in the n $\rightarrow$ 3s optical transition of cyclic ketones. Cornish, T.J. (Univ. of North Carolina, Chapel Hill (USA)); Baer, T. *Journal of the American Chemical Society (USA),* 110(19): 6287-6291 (14 Sep 1988).

The n $\rightarrow$ 3s transition energies of cold methylcyclopentanones and -cyclohexanones, as well as those of some branched-chain and bicyclic ketones, have been measured with 2 + 1 resonance-enhanced multiphoton ionization (REMPI). The energy shifts of the n $\rightarrow$ 3s transition origins are found to correlate in a linear fashion with reported ^{13}C NMR chemical shifts of the carbonyl carbon atoms. Several possible explanations for the experimental connection to NMR are discussed including consideration of both the paramagnetic and diamagnetic shielding contributions to the total chemical shift. 31 references, 3 figures, 1 table.

31534 Infrared spectrum of $F^- \times H_2O$. Yates, B.F. (Univ. of Georgia, Athens (USA)); Schaefer, H.F. III; Lee, T.J.; Rice, J.E. *Journal of the American Chemical Society (USA),* 110(19): 6327-6332 (14 Sep 1988). DOE Contract FG09-87ER13811.

Ab initio molecular structure methods have been used in conjunction with high-quality basis sets to determine the geometry and vibrational frequencies of the $F^- \times H_2O$ system at the self-consistent-field (SCF) and configuration interaction with single and double excitation (CISD) levels of theory. At the CISD level, the largest basis set used was a triple-ζ with two sets of polarization functions and a set of diffuse functions (TZ2P + diff). Anharmonic corrections were determined at the SCF level with a complete quartic force field. In addition, a one-dimensional CISD potential energy surface corresponding to the vibrational mode with the largest predicted infrared intensity (ν_2, the asymmetric F-H-O stretch) has been evaluated. Significant deviations from the harmonic approximation are found. At the CISD/TZ2P + diff level of theory, the ω_2 harmonic vibrational frequency is 2670 cm^{-1} for $F^- \times H_2O$ and 1955 cm^{-1} for $F^- \times D_2O$. With the inclusion of anharmonic effects, the ν_2 fundamental frequencies are predicted to be 1853 cm^{-1}

($F^- \times H_2$) and 1481 cm^{-1} ($F^- \times D_2O$). The calculations confirm that the $F^- \times H_2O$ system is strongly hydrogen bonded and is therefore a likely candidate to be observed via high-resolution infrared spectroscopy. 66 references, 3 figures, 7 tables.

31535 Classical and quantum pictures of reaction dynamics in condensed matter: resonances, dephasing, and all that. Onuchic, J.N. (Universidade de Sao Paulo, Sao Carlos (Brazil)); Wolynes, P.G. *Journal of Physical Chemistry (USA),* 92(23): 6495-6503 (17 Nov 1988).

A remarkably rich picture of the dynamics of chemical reactions in condensed-phase systems has emerged in recent years. The interplay of friction, electronic nonadiabaticity, and intramolecular energy flow have been elucidated by use of pictures based on classical trajectories. The authors review the qualitative ideas of that picture. There are some significant limitations of that approach to reaction dynamics that arise from quantum interference effects. Using a trajectory picture along with the quantum superposition principle, they give qualitative arguments describing how the transmission coefficient for nonadiabatic barrier crossing can be affected by resonances. They highlight the connections and differences between classical friction and quantum mechanical dephasing effects in barrier crossing. They also discuss the relation of this trajectory-based picture and the traditional language of radiationless processes based on the Golden Rule and master equations.

31536 Observation of reactive o-quinodimethanes by flow NMR. Trahanovsky, W.S. (Iowa State Univ., Ames (USA)); Chou, C.H.; Fischer, D.R.; Gerstein, B.C. *Journal of the American Chemical Society (USA),* 110(19): 6579-6581 (14 Sep 1988). DOE Contract W-7405-ENG-82.

The detection of 1,2-dimethylene-1,2-dihydronaphthalene (2) and o-xylylene (1) in the presence of its stable dimers by the technique of flow ^1H NMR is reported. The NMR flow apparatus used for this study was patterned after that of Fyfe; however, the apparatus was designed so that flow rates could be varied by changing the transfer and detector volumes. It was determined by uv-vis spectrometry that 2 is about 100 times less reactive than 1, and it was even possible to obtain the ^1H NMR spectrum of 2 before it dimerizes. The high reactivity of 1 made it impossible to obtain its spectrum in the absence of its dimer. 27 references, 1 figure.

31537 Time-resolved reaction of $O_2(^1\Delta)$ with I^- in aqueous solution. Braathen, G. (Lawrence Berkeley Lab., CA (USA)); Chou, P.T.; Frei, H. *Journal of Physical Chemistry (USA),* 92(23): 6610-6615 (17 Nov 1988). DOE Contract AC03-76SF00098.

The rate constant for quenching of $O_2(^1\Delta)$ by I^- in room temperature aqueous solution has been determined by time-resolved measurement of the $O_2{}^1\Delta \rightarrow {}^3\Sigma^-$ emission at 1.3 μm as (8.7 {plus minu} 0.2) $\times 10^5$ L mol^{-1} s^{-1}. Direct evidence for oxidation of I^- by $O_2(^1\Delta)$ was obtained by simultaneous time-resolved observation of $O_2(^1\Delta)$ reactant decay and I_3^- product growth in H_2O and D_2. The rate constant of the I_3^- rise, measured by transient absorption spectroscopy in the blue spectral range, was found to be equal to that of the $O_2(^1\Delta)$ decay. The most probable mechanism consistent with this result involves formation of HOOI, followed by fast reaction of this intermediate with I^- to give I_3^- and hydrogen peroxide.

31538 Potentiometric determination of the molal formation constants of ferrous acetate complexes in aqueous solutions to high temperature. Palmer, D.A. (Oak Ridge National Lab., TN (USA)); Drummond, S.E. *Journal of Physical Chemistry (USA),* 92(23): 6795-6800 (17 Nov 1988). DOE Contract AC05-84OR21400.

The formation quotients of ferrous acetate complexes were determined in aqueous solutions from 50 to 295°C at ionic strengths of 0.03, 0.1, 0.3, and 1.0 m using sodium trifluoromethanesulfonate as the supporting electrolyte. The potentiometric titrations were carried out in a Teflon-lined concentration cell fitted with hydrogen electrodes. Three complexes, namely, $Fe(CH_3COO)_n^{2-n}$, where n = 1, 2, and 3, were identified by regressional analysis of the data. The relevant thermodynamic quantities were calculated for the first two species.

31539 Production of the nitromethane aci ion by static high pressure. Engelke, R. (Los Alamos National Lab., NM (USA)); Schiferl, D.; Storm, C.B.; Earl, W.L. *Journal of Physical Chemistry (USA),* 92(23): 6815-6819 (17 Nov 1988).

The authors present experimental evidence that static high pressure (~2 GPa) produces an increased concentration of the aci ion [$CH_2NO_2^-$] of nitromethane [CH_3NO_2]. The presence of this form is inferred from hydrogen/deuterium isotope exchange between CH_3NO_2 and CD_3NO_2 induced by pressure. Control experiments in which isotope exchange is produced chemically and in which it is shown that temperature alone does not produce the exchange are described. The Raman spectral diagnostic used to identify the isotope-exchange process at high pressure is analyzed by use of ab initio calculations of the vibrational spectra of the four H/D nitromethane isotopomers. Ambient-pressure ^{13}C NMR was used to establish the chemistry involved in the isotope-exchange process. Their observation that pressure causes an increased aci ion concentration provides an explanation of nitromethane's observed pressure-dependent self-explosion behavior.

31540 Electron donor-acceptor properties of porphyrins, phthalocyanines, and related ring chelates: a molecular orbit approach. Fierro, C. (Case Western Reserve Univ., Cleveland, OH (USA)); Anderson, A.B.; Scherson, D.A. *Journal of Physical Chemistry (USA),* 92(24): 6902-6907 (1 Dec 1988).

Tetraazaporphyrin is used as a primitive fragment to examine theoretically the electron donor-acceptor properties of a variety of highly conjugated planar ligands of the porphyrins and phthalocyanine type. Calculations employing the atom superposition electron delocalization MO theory indicate that for iron macrocylces the energy gap between the occupied d_{xz}, d_{yz} orbitals and the empty $e_g(\pi^*)$ ring orbitals plays a key role in controlling the extent of metal to ring back-bonding. This provides a framework for a rational search of structural modifications of chelating ligands that may afford an optimized activation of axially coordinated π electron acceptor molecules such as dioxygen, nitric oxide, and carbon monoxide. The higher reactivity of iron(II) porphyrins toward such π acceptor species, compared to iron(II) phthalocyanine, is attributed to the longer Me-N bond length in the porphyrins, which leads to less metal to ligand back-bonding and thus to more electron charge at the metal center.

31541 Excitation transport in glycerol solutions of rhodamine 640: absence of orientational correlation. Causgrove, T.P. (Iowa State Univ., Ames (USA)); Bellefeuille, S.M.; Struve, W.S. *Journal of Physical Chemistry (USA),* 92(24): 6945-6948 (1 Dec 1988). DOE Contract W-7405-ENG-82.

Electronic excitation transport (EET) was studied for 0.246-5.61 mM solutions of rhodamine 640 in glycerol by obtaining anisotropic fluorescence profiles through time-correlated single-photon counting. These experiments were compared with polarized ground-state recovery dynamics monitored in pump=probe experiments. Unlike 3,3'-diethyloxadicarbocyanine iodide (DODCI) in glycerol, rhodamine 640 in glycerol exhibits EET that conforms closely with the two-particle Huber theory for concentrations up to 5.61 mM. The absence of the discrepancies observed for DODCI in glycerol indicates that the rhodamine 640 $S_0 \rightarrow S_1$ transition moments are randomly moments are randomly oriented in this solvent.

31542 Raman and surface-enhanced Raman study of asymmetrically substituted viologens. Lu, T. (Univ. of Nebraska, Lincoln (USA)); Cotton, T.M.; Hurst, J.K.; Thompson, D.H.P. *Journal of Physical Chemistry (USA),* 92(24): 6978-6985 (1 Dec 1988). DOE Contract FG02-84ER13261;AC06-83ER13111.

The normal Raman (NR), resonance Raman (RR), surface-enhanced Raman scattering (SERS), and surface-enhanced resonance Raman scattering (SERRS) spectra of the three redox forms of several asymmetric viologens, N-octyl-N'-methylviologen (C_8MV), N-dodecyl-N'-methylviologen ($C_{12}MV$), and N-hexadecyl-N'-methylviologen ($C_{16}MV$), have been characterized and compared with the corresponding spectra of the three redox forms of methylviologen (MV). It was observed that the substituents of the two N atoms of the viologen do not affect its overall symmetry. Only the Raman bands near 1200 cm^{-1}, containing major contributions from the N-alkyl stretching vibrations, are affected by the asymmetric substitution. The RR spectra of both the monomer and dimer forms of the cation radicals were obtained by varying the experimental conditions used in their preparation. As previously observed for MV,

dimerization of the asymmetric viologen radicals produces splitting of certain RR bands. Resonance Raman spectra of the fully reduced viologens were also obtained and used to monitor the disproportionation reaction between the dication and fully reduced form of the viologen. Surface-enhanced Raman and SERRS spectra of the different asymmetric viologens were found to vary slightly due to changes in their adsorption behavior with increasing chain length of the alkyl substituent.

31543 A classical trajectory study of intramolecular vibrational relaxation and unimolecular decomposition in methyl hydroperoxide. Gai, H. (Department of Chemistry, Oklahoma State University, Stillwater, Oklahoma 74078(US)); Thompson, D. L.; Fisk, G. A. *Journal of Chemical Physics (USA),* 90(12): 7055-7063 (15 Jun 1989).

This paper presents a quasiclassical trajectory study of the energy flow that occurs consequent to high-overtone excitations of either a CH or an OH local mode in methyl hydroperoxide, CH_3OOH. The potential energy surface employed is an empirical one based on available spectroscopic, thermodynamic, and theoretical data. Energy initially localized in a CH stretch transfers irreversibly on the time scale of the calculations into the methyl bending modes within 0.2 ps. Transfer of energy out of the methyl group to the rest of the molecule occurs more slowly. An initially excited OH bond retains energy longer than does a CH bond and, unlike the energy transfer for an excited CH stretch, partial recurrences in the energy content of the OH mode occur for some excitations. Vibrational resonances are important in determining the rates and pathways of energy flow in the molecule. At total energies near 104 kcal/mol the rate of the O–O bond scission is twice as fast for OH excitation as it is for CH excitation.

31544 Energy distribution of the CN products of the H+HCN, H+ClCN, and F+HCN reactions. Johnston, G. W. (Department of Chemistry, Columbia University, New York, New York 10027(US)); Bersohn, R. *Journal of Chemical Physics (USA),* 90(12): 7096-7102 (15 Jun 1989).

Three reactions of the type X+YCN→XY+CN (X, Y=H, H; H, Cl; F, H) were studied by probing the internal state distribution of the CN product. The fraction of the available energy released as CN rotation is very small consistent with theoretical predictions that these reactions are collinear abstractions. At higher incident kinetic energies of the X atom a larger fraction of the available energy is released into rotation, suggesting that the reactive collision can take place at larger angles of attack. In the reverse reaction CN+HD→HCN(DCN) +D(H) using rapidly rotating CN as a reactant the [H]/[D] ratio is 1.4±0.1.

31545 Dynamics of molecular hydrogen adsorbed in CoNa-A zeolite. Nicol, J.M. (Univ. of Maryland, College Park (USA)); Eckert, J.; Howard, J. *Journal of Physical Chemistry (USA),* 92(25): 7117-7121 (15 Dec 1988).

The dynamics of molecular hydrogen adsorbed in the cavities of partially cobalt exchanged type A zeolite ($Co_{4.1}Na_{3.8}$-A) has been investigated in the energy range 0-40 meV by incoherent inelastic neutron scattering. Both rotational and vibrational excitations are identified in the spectra. The rotational tunnel splitting of the librational ground state of the adsorbed molecular hydrogen is observed at 3.8 meV. Analysis of the data in terms of a 2-fold cosine potential with two degrees of rotational freedom best accounts for the observed spectral features among several models tested. A barrier height of about 1.4 kcal/mol is calculated. A mode at 15.3 meV is accordingly assigned as a vibration of the bound hydrogen. Evidence for the torsional mode of $Al(OH)_4$ complexes, formed in the β-cages during ion exchange, is found in the vibrational spectra at 21 meV.

31546 Vapor-liquid equilibria in fluids of two-center Lennard-Jones molecules. Gupta, S. (Louisiana State Univ., Baton Rouge (USA)). *Journal of Physical Chemistry (USA),* 92(25): 7156-7150 (15 Dec 1988). DOE Contract FG05-86ER13632.

Molecular dynamics simulations are performed using 500 molecules for pure fluids of two-center Lennard-Jones (12:6) molecules to obtain thermodynamic results, including the residual Helmholtz free energy, for several isotherms. Thermodynamic results obtained from these simulations are utilized to predict the vapor-liquid equilibria in these fluids. Simulation results have also been used to estimate the critical temperatures and critical densities of these fluids, and these are compared with the existing predictions from three theoretical methods. These comparisons show that the site-site Ornstein-Zernike equation, with the Percus-Yevick approximation, for these fluids overpredicts the critical temperatures, and a nonspherical reference potential based perturbation theory also shows small deviations whereas an approximate form of the zeroth-order Mayer function expansion cluster perturbation theory works well. These three methods predict well the critical densities of these fluids, within the combined uncertainties of the results.

31547 Oxygen fluoride chemical kinetics. Lyman, J.L. (Los Alamos National Lab., NM (USA)); Holland, R. *Journal of Physical Chemistry (USA),* 92(26): 7232-7241 (29 Dec 1988).

This paper reports the results of a study of the reactions of fluorine atoms with oxygen. The fluorine atoms are produced by photolysis of molecular fluorine with an excimer laser (KrF, 248 nm). Subsequent reactions produce (and consume) the species O_2F and O_2F_2. The reaction mechanism and rate constants for six reactions follow from the analysis of transient absorption signals. The signals were obtained with an ultraviolet lamp at 215 nm. Both of the oxygen fluorides absorb at that wavelength. The experiments also gave the absorption cross sections of the two species at the probe wavelength and an enthalpy of formation for O_2F. Some of the rate constants are different from those reported earlier. This is most likely due to their avoidance of assumptions made by authors. All experiments were at room temperature, but they estimated the temperature dependence of the set of reaction rates using the measured rate constants and published, measured, and calculated thermodynamic properties.

31548 Potential sensitivity of tunneling in isolated resonance unimolecular reaction theory. Wagner, A.F. (Argonne National Lab., IL (USA)). *Journal of Physical Chemistry (USA),* 92(26): 7259-7260 (29 Dec 1988). DOE Contract W-31-109-ENG-38.

A recent article by Wagner and Bowman indicated that the inclusion of tunneling in the calculation of the low-pressure limit of the thermal addition of H + CO produced rate constants that were inconsistent with available experimental measurements. A recent note by Pritchard points out that the conventional calculation of tunneling in the low-pressure limit can be sensitive to small variations of the potential energy surface. He argues that, without further investigation of potential sensitivity, it may be premature to argue that conventional tunneling is inconsistent with experiment. The result suggest that variation in potential parameters, even though they change tunneling probabilities by many orders of magnitude, do not change the qualitative dependence of the local low-pressure limit on pressure. Only if tunneling is significantly reduced for all states, is the onset pressure for the step in the low-pressure limit from the highest energy tunneling state partially shifted out of the experimental range.

31549 The effects of substrate roughness on ultrathin water films. Garoff, S. (Department of Physics, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213(US)); Sirota, E. B.; Sinha, S. K.; Stanley, H. B. *Journal of Chemical Physics (USA),* 90(12): 7505-7515 (15 Jun 1989).

Real surfaces are rough and chemically heterogeneous on many length scales and wetting phenomena on these surfaces are affected by this inhomogeneous nature. We have used x-ray reflectivity to examine the structure of static precursing films which precede the macroscopic meniscus of water on glass. We have examined the thickness of the film, the roughness of the interfaces bounding the film, and the conformality or correlations between the roughness features of these bounding interfaces. The wetting film consists of three basic components: the bulk meniscus, a thin ($\leq$100 A) precursing wetting film which has a sudden termination, and beyond that, a much thinner film characteristic of the glass surface in contact with water vapor only. The roughness and chemical heterogeneity of the solid manifest themselves in the roughness of the water/vapor interface of the film, in the irregularity of the terminating boundary of the precursor wetting film, and in the hysteretic pinning of that boundary. The roughness of the glass surface is observed to impose additional roughness to the water/vapor interface beyond that which would exist on a bulk interface. These results are discussed in terms of the disjoining pressure which governs the behavior of such films.

31550 Reply to Comment on: Accurate three-dimensional quantum scattering calculations for F+H_2→HF+H. Zhang, J. Z. H. (Department of Chemistry, University of California, and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720(US)); Miller, W. H. *Journal of Chemical Physics (USA),* 90(12): 7610-7610 (15 Jun 1989).

The fluorine + hydrogen reaction is studied quantum mechanically. The total reaction probability seems to be in good agreement with Yu et al. (ref. 1). Some of the calculations are repeated and found to agree well with other groups.(AIP)

4004 Electrochemistry

Refer also to citation(s) 30268, 31046, 31047, 31236, 31237, 31243, 31292, 31353, 31443, 31444, 31450, 31498, 31520, 31564

31551 (LBL–27123) **Steady-state and impedance analyses of electrochemical kinetics and mass transfer.** Hauser, A.K. Lawrence Berkeley Lab., CA (USA). c Apr 1989. 408p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. Order Number DE89012768/JAW. Available from NTIS, PC A18/MF A01 - OSTI; GPO Dep.

Results of several interrelated studies concerning the nature of the dc-polarization and frequency-response characteristics of a rotating disk electrode are reported. All results are for the electrodissolution of a copper disk in 0.1 N HCl unless specified otherwise.

31552 Polishable and robust modified graphite epoxy electrodes. Wang, J. (New Mexico State Univ., Las Cruces (USA)); Golden, T.; Varughese, K.; El-Rayes, I. *Analytical Chemistry (USA),* 61(5): 508-512 (1 Mar 1989).

The field of chemically modified electrodes (CMEs) has been the focus of a high level of activity since its inception about 15 years ago. Substantial enhancements of the sensitivity, selectivity, or stability of electroanalytical measurements have been achieved by using electrodes modified with an appropriate preconcentrating agent, by incorporating redox mediators that accelerate electrochemical reaction rates, or by coating the surface with a permselective film. Despite the enormous potential of CMEs for chemical analysis, such devices are rarely used for routine quantitative measurements and are not available from commercial sources. This note describes the fabrication and performance of graphite epoxy modified electrodes, which exhibit desired characteristics for real-life applications. The epoxy-bonded graphite is a commercial two-component, graphite-filled, epoxy resin bonded adhesive filler (Grade RX, Dylon, Cleveland, OH).

31553 Solid-state voltammetry in a three electrode electrochemical cell-on-a-chip with a microlithographically defined microelectrode. Morita, M. (Univ. of North Carolina, Chapel Hill (USA)); Longmire, M.L.; Murray, R.W. *Analytical Chemistry (USA),* 60(24): 2770-2775 (15 Dec 1988).

Microlithographic procedures are employed to fabricate electrochemical microcells with three coplanar gold-film electrodes (working, auxiliary, and reference) resting on a silicon water. The working electrode can be a 11 × 516 or 11 × 256 μm microband or a 11 × 11 μmicrosquare, and the cell solution of a film of an ionically conducting polymer such as lithium triflate dissolved in poly(ethylene oxide). The cyclic voltammetry and chronoamperometry of electroactive species dissolved in these cell media are reported, and the chronoamperometric data are compared to theoretical current-time curves calculated for band microelectrodes. Cyclic voltammetry in an aqueous droplet on the microsquare gives pseudo-steady-state-waves, the limiting currents of which quantitatively agree with those for microdisk electrodes of equivalent area. The microlithographically defined microcells can be produced in quantity and can be considered disposable electroanalytical devices, which can be advantageous for routine electroanalytical applications involving electrode-poisoning reaction systems.

31554 Resonance Raman spectra of electrochemically generated chlorophyll a cation radical. Heald, R.L. (Univ. of Nebraska, Lincoln (USA)); Callahan, P.M.; Cotton, T.M. *Journal of Physical Chemistry (USA),* 92(17): 4820-4824 (25 Aug 1988). DOE Contract FG02-84ER13261.

Soret excitation resonance Raman (RR) spectra of electrochemically generated chlorophyll a cation radical (Chl $a^{+\cdot}$) have been obtained in two solvent systems, dry CH_2Cl_2 and CH_2Cl_2 with added CH_3OH. The major RR changes observed upon ChI a oxidation are a five-wavenumber downshift of the 1611- and 1491-cm^{-1} core-size-sensitive, intensity and frequency changes in the C_aN stretching region (1300-1400 cm^{-1}), a loss of intensity for $\nu(C_9{=}O)$ at 1687 cm^{-1}, and the presence of a new band at 1717 cm^{-1}. The significant change in the carbonyl stretching region indicates that there is a large change in electron density at ring V and its peripheral substituents with oxidation and further suggests that Chl $a^{+\cdot}$ favors the end form of the C_9 keto group.

4005 Photochemistry

Refer also to citation(s) 30447, 31234, 31293, 31341, 31344, 31512, 31542, 31547

31555 Phototransformations of benzopyranols and related systems. Steady-state and laser flash photolysis studies. Ramaiah, D. (Indian Institute of Technology, Kanpur); Scaria, P.M.; Cyr, D.R.; Das, P.K.; George, M.V. *Journal of Organic Chemistry (USA),* 53(9): 2016-2022 (29 Apr 1988).

The phototransformations of several 4-benzopyranol systems incorporating the 1,2-dibenzoylalkene moiety have been studied for steady-state photolysis, product analysis, and nanosecond laser flash photolysis. Under direct photolysis, prototropic reactions leading to 2-pyranols and/or their methoxy analogues are shown to dominate, presumably through the intermediacy of carbocations produced as a result of photodehydroxylation. No products, e.g., butenoic acid/ester derivatives, attributable to intramolecular phenyl groups migration along the 1,2-di-benzoylalkene moiety, are observed. The laser flash photolysis of 4- and 2-pyranols in benzene or methanol shows the formation of triplets, characterized by unusually short lifetimes (submicrosecond), which testify to the reactive nature of the triplets. In addition, in the case of 2-pyranols, longer-lived transient species characterized by absorptions at long wavelengths (700-800 nm) are observed; these are best assigned as biradicals, produced as a result of ring-opening via triplet-mediated C_2-O bond cleavage. 29 references, 3 figures, 1 table.

31556 Photoinduced electron transfer and back transfer in systems of randomly distributed donors and acceptors: picosecond transient grating experiments. Dorfman, R.C. (Stanford Univ., CA (USA)); Lin, Y.; Zimmt, M.B.; Baumann, J.; Domingue, R.P.; Fayer, M.D. *Journal of Physical Chemistry (USA),* 92(15): 4258-4260 (28 Jul 1988). DOE Contract FG03-84ER13251.

Electron transfer from an optically excited donor (rubrene) to randomly distributed acceptors (duroquinone) followed by electron back transfer in a rigid solution (sucrose octaacetate) has been studied theoretically and experimentally. The forward electron transfer process was observed by time-dependent fluorescence quenching measurements, while the electron back transfer from the radical anion to the radical cation was monitored by using the picosecond transient grating (TG) technique. A statistical mechanics theory is used to describe the highly exponential TG signals and to extract the forward and back transfer parameters from the data. The agreement between the theory and experiments is excellent. The values of the forward and back transfer parameters are reported.

31557 Photophysics of the phases of poly(di-n-hexylsilane). Thorne, J.R.G. (Univ. of Pennsylvania, Philadelphia (USA)); Hochstrasser, R.M.; Zeigler, J.M. *Journal of Physical Chemistry (USA),* 92(15): 4275-4277 (28 Jul 1988). DOE Contract AC04-76DP00789.

Time-resolved fluorescence and fluorescence anisotropy measurements have been performed on solution, glass, film and powdered phases of the high molecular weight polysilane poly(di-n-hexylsilane). The emission lifetime is 4 times longer in crystalline compared to solution phases of the polymer, but the decay of anisotropy is essentially unchanged. Evidence is presented for an isolated rodlike phase at low temperature.

31558 Polyelectrolyte-stabilized metal oxide hydrosols as catalysts for the photooxidation of water by zinc porphyrins. Nahor, G.S. (National Bureau of Standards, Gaithersburg, MD

(USA)); Mosseri, S.; Neta, P.; Harriman, A. *Journal of Physical Chemistry (USA),* 92(15): 4499-4504 (28 Jul 1988).

Colloids of ruthenium dioxide and iridium oxide have been prepared and characterized. These colloids, which are inherently negatively charged in neutral water, have been stabilized with a surface layer of polyelectrolyte. Electrostatic binding occurs between the stabilized colloids and water-soluble zinc porphyrins of the opposite electronic charge. Such electrostatic forces affect the rate constant for interfacial electron transfer between the colloids and radical cations derived from the zinc porphyrins. The products of these reactions depend upon the relative charges of the reactants. For oppositely charged reactants, the rate of interaction was very high but O_2 generation was not observed. In some cases where the porphyrin and colloid possess the same charge, the system can be used to oxidize water to O_2 under photochemical conditions. The yield of O_2 depends upon the solution pH and the nature of both reactants. With negatively charged reactions in alkaline solution, the authors have reported quantum efficiencies for O_2 generation in the range of 50-60%. With positively charged reactants, oxygen formation could be observed in acidic solution, although the quantum efficiencies were less than 10%.

31559 Interaction of halide and pseudohalide ions with triplet benzophenone-4-carboxylate: kinetics and radical yields. Hurley, J.K. (Brandeis Univ., Waltham, MA (USA)); Linschitz, H.; Treinin, A. *Journal of Physical Chemistry (USA),* 92(18): 5151-5159 (8 Sep 1988).

The interaction between triplet benzophenone-4-carboxylate (^{3}BC) and some inorganic anions, X^-, has been studied by laser flash photolysis over a wide range of anion concentration (up to 6 M), at pH 11 and constant ionic strength. Spectra and extinction coefficients of ^{3}BC and $BC^{\cdot -}$ radical were determined by using the benzophenone actinometer. Triplet lifetime measurements gave primary interaction rate constants, k_q^T (M^{-1} s^{-1}), close to diffusion controlled for iodide, thiocyanate, and azide ($k \approx s \times 10^9$), somewhat less for bromide (2×10^8) and very low for chloride ($< 10^6$). Radical yields, φ_R, as f[X^-], pass through a broad minimum around [X^-] = 0.01 M, which is close to zero for I^-, Br^-, and SCN^- and small but finite (≈ 0.015) for N_3^-. At [X^-] > 0.1 M, φ_R increases with [X^-] and equivalent amounts of $BC^{\cdot -}$ and X_2^- radicals are formed, including N_6^-. At high anion concentrations, plots of φ_R^{-1} versus $[X^-]^{-1}$ are linear. Limiting φ_R ∞ values, extrapolated to $[X^-]^{-1} = 0$, range from 0.60 for SCN^- to 0.06 for N_3^-. These results are interpreted, as in the authors earlier work on anthraquinonesulfonate, in terms of trapping a primary triplet exciplex by a second anion at high concentration to form a termolecular exciplex with low orbital momentum, which may dissociate to the observed radical products (intraradical spin-orbit coupling model). Competitive deactivation process also occur from these exciplexes and possibly from other high-concentration interactions as well.

31560 Infrared multiphoton dissociation of ethyl and methyl acetate. Hintsa, E.J. (Lawrence Berkeley Lab., CA (USA)); Wodtke, A.M.; Lee, Y.T. *Journal of Physical Chemistry (USA),* 92(19): 5379-5387 (22 Sep 1988).

The collisionless decompositions of ethyl and methyl acetate was investigated with IR multiphoton dissociation. With a fluence of 40 J/cm^2, ethyl acetate gave 97% concerted decomposition producing ethylene and acetic acid, the latter of which underwent significant secondary decomposition to ketene and water. Simple bond rupture producing ethyl radical and CH_3CO_2, which completely decomposed to CH_3 and CO_2, accounted for the remaining reaction produce. Methyl acetate underwent concerted reaction to produce methanol and ketene and simple bond rupture to form CH_3 and CH_3CO_2, in near equal amounts. All of the concerted reactions released more than half ($\approx$20 kcal/mol) of the exit channel barrier into translational energy. From the branching ratio between the two channels and the translational energy distribution of the simple bond rupture channel, the barrier for concerted reaction in methyl acetate was determined to be 69 ± kcal/mol.

31561 Photofragmentation of acetone at 193 nm: rotational- and vibrational-state distributions of the CO fragment by time-resolved FTIR emission spectroscopy. Woodbridge, E.L. (National Bureau of Standards, Boulder, CO (USA)); Fletcher, T.R.; Leone, S.R. *Journal of Physical Chemistry (USA),* 92(19): 5387-5393 (22 Sep 1988).

Photofragmentation of acetone at 193 nm is known to produce predominantly two methyl radicals and a CO molecule. Infrared emission is collected for the CO fragment at time delays of 6-30 μs after the exciting laser pulse by a time-resolved Fourier transform spectrometer. High-resolution vibration-rotation spectra are obtained both under collision-free and rotationally relaxed conditions. The observed vibrational distribution is, for v = 1/2/3, 0.73 ± 0.04/0.23 ± 0.02/0.04 ± 0.01. This distribution fits a temperature of $\sim 2030_{-430}^{+730}$ K, in approximate agreement with previous low-resolution results from this laboratory. The observed rotational distribution is highly excited, approximating a temperature of 3360_{-800}^{+1540} K. Both the vibrational and rotational distributions can be successfully modeled by using a pure impulsive mechanism for the fragmentation of an initial bent acetyl fragment. Thus, the observed distribution supports previous arguments that the dissociation occurs by a two-step fragmentation mechanism following single-photon excitation.

31562 Photochemistry of O_3/HNCO mixtures. Ongstad, A.P. (Univ. of Denver, CO (USA)); Liu, X.; Coombe, R.D. *Journal of Physical Chemistry (USA),* 92(20): 5578-5580 (6 Oct 1988).

Pulsed photolysis of gaseous O_3/HNCO mixtures at 249 nm produces emission from the NH $A^3\Pi \rightarrow X^3\Sigma^-$ transition near 336 nm. The data suggest that the excited NH is produced by the reaction $O(^1D) + HNCO \rightarrow NH + CO_2$. The branching fraction to the alternate products OH + NCO is less than 0.1. This mechanism is quite different from that of the analogous $O(^1D) + HN_3$, $NH(^1\Delta) + HN_3$, and $NH(^1\Delta)$ + HNCO reactions. From the time profile of the NH emission, the rate constant for $O(^1D)$ + HNCO is determined to be $(4.6 \pm 0.4) \times 10^{-11}$ cm^3s^{-1}.

31563 Determining reaction pathways and spin-orbit populations in the photodissociation of HBr and HI using velocity-aligned Doppler spectroscopy. Xu, Z. (Univ. of Southern California, Los Angeles (USA)); Koplitz, B.; Wittig, C. *Journal of Physical Chemistry (USA),* 92(19): 5518-5523 (22 Sep 1988).

The technique of velocity-aligned Doppler spectroscopy (VADS) is used to investigate the photodissociation of HBr (193 nm) and HI (193 and 248 nm). Doppler profiles at Lyman-α for the H-atom photofragment are reported, and the corresponding populations of the halogen atom $^2P_{3/2}$ and $^2P_{1/2}$ spin-orbit states are determined. The VADS technique facilitates measurement of spatial anisotropy (β's) for each spin-orbit state. For HI photolyzed at 248 nm, $I(^2P_{3/2})$ and $I(^2P_{1/2})$ are produced with relative populations 0.54 ± 0.05 (β = -1.0 ± 0.2) and 0.46 ± 0.05 (β = 1.7 ± 0.2), respectively, while 193-nm HI photodissociation yields an $I(^2P_{3/2})$ population of $\geq$ 0.9 ($\beta \approx -1.0$). For 193-nm HBr photodissociation, the $Br(^2P_{3/2})$ and $Br(^2P_{1/2})$ populations are 0.86 and 0.14, respectively. Surprisingly, both channels appear to originate primarily from a perpendicular transition, since β is ~ -1.0 for each state. This is in contrast to the case of HI, and plausible excitation and dissociation mechanisms are discussed in terms of possible coupling schemes.

31564 Mechanistic aspects of the photooxidation of water at the n-TiO_2/aqueous interface: optically induced transients as a kinetic probe. Norton, A.P. (Princeton Univ., NJ (USA)); Bernasek, S.L.; Bocarsly, A.B. *Journal of Physical Chemistry (USA),* 92(21): 6009-6016 (20 Oct 1988). DOE Contract FG02-85ER13438.

The method of optically induced photocurrent transients is a powerful tool for probing the mechanisms of photoinduced charge transfer at the semiconductor/electrolyte interface. Using this technique on the TiO_2/aqueous interface, the authors conclude that water oxidation occurs via an outer-sphere process for electrolyte pH < 12 and an inner-sphere mechanism at more basic pH's. Hydrogen isotope effects on the observed transient substantiate this finding. These isotope effects along with selective poisoning studies suggest a Ti-OH surface species as the key intermediate for the inner-sphere channel, along with the cleavage of a hydrogen bond as the rate-limiting process (H/D kinetic isotope effect of $\approx$ 10) in basic electrolyte. These studies further indicate a strong crystal face dependence on the observed photoelectrochemistry.

31565 Effect of triplet spin dynamics memory in electron-transfer reactions. Fourier transform-electron paramagnetic resonance spectroscopy. Angerhofer, A. (Argonne National Lab., IL (USA)); Toporowicz, M.; Bowman, M.K.; Norris, J.R.; Levanon, H. *Journal of Physical Chemistry (USA),* 92(26): 7164-7166 (29 Dec 1988). DOE Contract W-31-109-ENG-38.

Electron-transfer reactions, in ethanol solutions at ≈ 243 K, between the photoexcited triplets of two metallotetraphenylporphyrins, ZnTPP and MgTPP (donors), and neutral duroquinone, DQ (acceptor), were studied by selective laser excitation-Fourier transform-EPR spectroscopy. The authors demonstrate that this highly time-resolved EPR differentiates between photochemical processes, occurring early in time, in similar chemical systems. The early spectra (10 ns < τ_d < 100 ns) of the $DQ^{\cdot-}$ generated by ^{3}Zn TPP are totally absorptive, reflecting the out-of-plane active triplet spin state of ^{3}ZnTPP. On the other hand, the early spectra of the $DQ^{\cdot-}$ radical generated by ^{3}MgTPP (10 ns < τ_d < 400 ns) are totally emissive, reflecting the in-plane active triplet spin state(s) of ^{3}MgTPP. These results verify that the CIDEP effects due to the triplet mechanism strongly depend on the triplet spin memory of the particular precursor. Qualitative analysis of the temporal changes of the signal intensities results in the following: (i) apparent spin-lattice relaxation (SLR) times of the triplet precursors, i.e., $T_1(^3ZnTPP) \approx 30$ ns, $T_1(^3MgTPP) \approx 200$ ns; (ii) SLR times of the doublet radicals, i.e., $T_1(DQ^{\cdot-}) \approx 7\text{-}8$ μs, in the presence of ZnTPP; $T_1(DQ^{\cdot-}) \approx 2\text{-}5$ μs, in the presence of MgTPP; (iii) electron-transfer rates, i.e., $k_{et}(^3ZnTPP+DQ) \approx 10^9$ M^{-1} s^{-1}, k_{et}-$(^3MgTPP+DQ) \approx 2 \times 10^8$ M^{-1} s^{-1}. They suggest that the different results, ZnTPP vs MgTPP systems, are due to triplet exciplex formation between ^{3}MgTPP and DQ.

31566 Long-lived quinone-naphthalene triplet excited complexes: direct measure of rates of proton transfer within intimate radical ion pairs. Jones, G. II (Boston Univ., MA (USA)); Mouli, N. *Journal of Physical Chemistry (USA),* 92(26): 7174-7177 (29 Dec 1988).

The quenching of the triplet state of chloranil (tetrachloro-p-benzoquinone) by derivatives of naphthalene in benzene results in the formation of relatively long-lived (τ = 100-350 ns) radical ion pair intermediates. For the electron donor naphthalenes having aliphatic side chain substitution, intrapair proton transfer can be directly monitored by laser flash photolysis. Measurement of radical ion pair (triplet excited complex) decay times and the quantum yields of resultant semiquinone (OH*) radicals provide rate constants for decay via intersystem crossing (k_{isc}) and intra-ion-pair proton transfer (k_H). The data reveal relative kinetic acidities of quinone-complexed radical cations and include activation parameters and isotope effects associated with the proton-transfer step.

31567 Ultraviolet absorption of the vinyl radical and reaction with oxygen. Fahr, A. (National Bureau of Standards, Gaithersburg, MD (USA)); Laufer, A.H. *Journal of Physical Chemistry (USA),* 92(26): 7229-7232 (29 Dec 1988).

Two absorption features at 164.71 and 168.33 nm have been detected from the vacuum ultraviolet flash photolysis of either $Sn(C_2H_3)_4$ or $Hg(C_2H_3)_2$. The features are assigned to the vinyl radical on the basis of precursor, kinetic data, and the spacing between the bands. Extinction coefficients of 1650 ± 500 and 1120 ± 500 cm^{-1} atm^{-1} (Napierian) for the two bands, respectively, have been measured, and a rate constant of (6.7 ± 2.7) × 10^{-12} cm^3 $molecule^{-1}$ s^{-1} for the reaction of $C_2H_3 + O_2$ has been determined.

4006 Radiation Chemistry

Refer also to citation(s) 30566

31568 (AD-A–204295/0/XAB) **Radiation-induced polymerization of cyclophosphazene trimers. Final report, 1 September 1985-30 September 1988.** Stannett, V.T. North Carolina State Univ., Raleigh, NC (USA). Dept. of Chemical Engineering. 4 Jan 1989. 25p. Available from NTIS, PC A03/MF A01.

Hexachlorophosphazene was irradiated in bulk and in solution after various methods of purification. When rigorously dried and purified, good yields of polymer were obtained. Poor reproducibility was found in the bulk but reasonably good results were obtained in decalin solution. The best yields and highest molecular weights were obtained after the addition of small amounts of the bulky electron acceptor pyromellitic dianhydride. Hexachlorocyclotriphosphazene was purified by recrystallization for various times from dried heptane. The trimer was then further purified by repeated sublimation steps under high vacuum. Finally the trimer was dried in the melt over rigorously baked out barium oxide. The monomer was then transferred to ampules or the NMR tubes for radiation and subsequent determination of the polymer content.

31569 (IEN-DQUI-DIQUI–04/80) **Influence of radiolytic degradation products from organic phase.** Azevedo, H.L.P. de. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). 1980. 13p. (In Portuguese). Order Number DE89613205/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The influence of primary and secondary degradation products from TBP - dodecane on zirconium extraction is studied. The presence of radiolytical degradation at organic phase, in systems of initial concentration of HNO/sub 3/1 and 4M, and absorbed γ radiation doses from 0,5 to 4,5 Wh/l, lead to an increase of zirconium extraction, being the HDBP the main product of degradation responsable by this effect. The influence of secondary degradation products is significative in systems of HNO/sub 3/1M initial concentration. The formation of precipitator in extractions of Zr in HNO/sub 3/1M with irradiated TBP-dodecane was observed. (M.C.K.).

31570 (INIS-mf–11406, pp. 100) **Detection of the irradiation of foods.** Swallow, A.J. (Paterson Inst. for Cancer Research, Manchester (UK)). European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, Israel, 24-30 Oct 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIOSTERILIZATION/quality control; RADICIDATION/quality control; RADURIZATION/quality control; FOOD; RADIOSTERILIZATION; RADICIDATION; RADURIZATION

31571 Hydrolytic and radiolytic degradation of OϕD (IB)CMPO; continuing studies. Nash, K.L. (Argonne National Lab., IL (USA)); Gatrone, R.C.; Clark, G.A.; Rickert, P.G.; Horwitz, E.P. *Separation Science and Technology (USA),* 23(12-13): 1355-1372 (Oct 1988). (CONF-871038–: 5. symposium on separation science and technology for energy applications, Knoxville, Tennessee, USA, 26-29 Oct 1987).

The hydrolytic and radiolytic degradation of octyl(phenyl)-N,N-diisobutylcarbamoyl-methylphosphine oxide (CMPO) in tetrachloroethylene (TCE) and in tributylphosphate-TCE mixtures (TRUEX process solvent) in contact with HNO_3 has been investigated. Gas chromatographic analysis of the degraded solutions has allowed identification and quantitation of a variety of organophosphorus degradation compounds derived from CMPO. The effect of degradation of the extractant solutions on the extraction and stripping of americium has been addressed, as has the effectiveness of Na_2CO_3 scrub procedures for restoring extractant performance. Extrapolation of these results to normal process application conditions indicates that neither hydrolysis nor radiolysis should compromise the americium extraction performance of TRUEX-TCE.

31572 Effect of pressure on the reaction of electrons with CO_2 in nonpolar solvents. Nishikawa, M. (Univ. of Tokyo (Japan)); Itoh, K.; Holroyd, R. *Journal of Physical Chemistry (USA),* 92(18): 5262-5266 (8 Sep 1988). DOE Contract AC02-76CH00016.

The effect of external pressure (to 2500 bar) on the reaction $e^- + CO_2 \rightleftarrows CO_2^-$ in three nonpolar solvents is reported. With increasing pressure, the equilibrium constant increases rapidly. The free energy of reaction decreases due to an increase in entropy change for the reaction at higher pressures. The observed volume changes are between −133 and −290 cm^3/mol for this reaction. The magnitude of the volume changes scales with the isothermal compressibility. Electrostriction of the solvent by CO_2^- accounts for most of the volume changes. The results are in reasonable accord with the classical theory of Drude and Nernst.

31573 Isotopic dependence of recombination kinetics in water. Chernovitz, A.C. (Argonne National Lab., IL (USA)); Jonah, C.D. *Journal of Physical Chemistry (USA)*, 92(21): 5946-5950 (20 Oct 1988). DOE Contract W-31-109-ENG-38.

The decay of the hydrated electron solvated by D_2O molecules, e_{aq}^- (D_2O), and the OD radical as well as the reactions of the precursor of the hydrated electron have been investigated in D_2O solution by using the Argonne stroboscopic pulse radiolysis system. These processes have been compared to the analogous reactions in H_2O. The decay of the electron is slower in D_2O relative to the corresponding species in H_2O, while the decay of the hydroxyl radical and the efficiencies of the electron scavengers in reducing the initial yield of the hydrated electron are comparable in both solvents. The OD radical absorbance decays to 0.75 ± 0.06 of its initial value from 200 ps to 3.0 ns. This parallels that for the OH radical (0.74 ± 0.06). The similarity of the electron scavenging efficiencies indicate a hydrated electron precursor that exists in a distinct, localized state for both D_2O and H_2O. The slower decay of the electron in D_2O has been interpreted as a greater thermalization distance and a broader initial spatial distribution for the electron in D_2O compared to H_2O. The spurs of the D_2O and H_2O systems have been modeled by using a spherically symmetric electron distribution around a Gaussian hydroxyl radical core. The computer simulations agree quite favorably with the experimental results.

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 30431, 30444, 31413, 31418, 31446

31574 (LHRL-LIB/Trans–4) **Labelling of TTHA coupled IgG and MCAb with rare earth radionuclides. I. research on labelling process.** Wu Younghui; Zhang Yulei; Wu Chuanchu; Wang Xiangyun; Liu Yuanfang. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Jul 1988. 16p. Order Number DE89615984/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Translation from the Chinese by Alfalfa Translating and Interpreting Service.

This article expands a process of labelling G-immunoglobulin (IgG) and monoclonal antibody (MCAb) with rare earth radionuclides. In this labelling process, cycloanhydride (CTTHAA) of Tri-ethyl Tetra-amine Hexa-acetic Acid (TTHA) is employed as a bifunctional chelating conjugate, the metal chelation takes place after CTTHAA has first been linked to IgG, followed by chemical reaction with rare earth radionuclides. Detailed investigations have been carried out to examine the influencing parameters of labelling globulins with rare earth, such as metal to CTTHAA mole-ratio, pH value and labelling time. The immunoreactivity of the labelled compound (RE-TTHA-IgG) has been retained throughout the whole labelling process.

31575 (ORNL/M–551/R1) **Isotopes: Products and services.** Oak Ridge National Lab., TN (USA). Mar 1989. 176p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89012235/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The US Department of Energy (USDOE) provides the isotopic materials and services listed in this catalog for distribution by sale through the Oak Ridge National Laboratory Isotope Distribution Office (ORNL/IDO) which is operated for the USDOE by Martin Marietta Energy Systems, Inc. Materials available include separated stable isotopes, byproduct radioisotopes, and research quantities of source and special nuclear materials. Isotope products are routinely available in the forms listed in the product description section of this catalog. Different forms can be provided in some cases usually at additional cost. Routinely available services include fabrication of special physical forms, source encapsulation, ion implantation, and special purification. Materials and services that are not offered as part of the routine distribution program may be made available on an individual basis as approved by the USDOE if they are not available from private, domestically owned producers in the United States.

31576 (RI–202) **Mathematical modelling of extraction dynamics in differential-contact extractor.** Dushin, V.N.; Perepech, K.V.; Shpunt, L.B. Radievyj Inst., Leningrad (USSR). 1988. 9p. (In Russian). Order Number DE89615964/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A mathematical model for the nonstationary extraction process in a differential-contact extractor is described. Averaging method is used to obtain an approximate analytical solution of the model problem corresponding to original set of equations. It is shown that the numerical solution of the set of equations converges in the limit to analytical solution. Numerical calculations of the transition to the stationary process are performed for a two-component extraction system containing nitric acid and uranyl nitrate (extractant - 30% in n-alkanes). 5 refs.; 2 figs.

31577 (SKB-TR–88-21) **Modelling uranium solubilities in aqueous solutions: Validation of a thermodynamic data base for the EQ3/6 geochemical codes.** Puigdomenech, I.; Bruno, J. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). 5 Oct 1988. 69p. Order Number DE89613120/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Experimental solubilities of U/sup 4+/and UO/sub 2//sup 2+/that are reported in the literature have been collected. Data on oxides, hydroxides and carbonates have been selected for this work. They include results both at 25 degrees C and at higher temperatures. The literature data have been compared with calculated uranium solubilities obtained with the EQ3/6 geochemical modelling programs and an uranium thermodynamic data base selected for the Swedish nuclear waste management program. This verification/validiation exercise has shown that more experimental data is needed to determine the chemical composition of anionic uranyl hydroxo complexes as well as their equilibrium constants of formation. There is also a need for more solubility data on well characterised alkaline or alkaline-earth uranates. For the uranyl carbonate system, the calculated results agree reasonably well with the experimental literature values, which span over a wide range of pH, (CO/sub 3// sup 2-/)/sub T/, CO/sub 2/(g)-pressure, and T. The experimental solubility of UO/sub 2/(s) agrees also well with the EQ3/6 calculations for pH greater than 6. However, in more acidic solutions the experimental solubilities are higher than the calculated values. This is due to the formation of polynuclear hydroxo complexes of uranium, which are not well characterised, and are not included in the thermodynamic data base used in this study. (authors).

31578 Crystal structures of $(MeC_5H_4)_4U_2(\mu\text{-}NR)_2$. Unsymmetrical bridging, R = Ph, and symmetrical bridging, R = $SiMe_3$, organoimide ligands in organoactinide compounds. Brennan, J.G. (Lawrence Berkeley Lab., CA (USA)); Andersen, R.A.; Zalkin, A. *Journal of the American Chemical Society (USA)*, 110(14): 4554-4558 (6 Jul 1988). DOE Contract AC03-76SF00098.

The tetravalent uranium complexes with bridging ligands, $(MeC_5H_4)_2(\mu\text{-}NR)_2$ have been prepared by the valence conproportionation reaction of $(MeC_5H_4)_3U\times thf$ and $(MeC_5H_4)_3UNR$. X-ray crystallographic study of R = Ph and $SiMe_3$ shows that the NPh group asymmetrically bridges the two uranium fragments, whereas the $NSiMe_3$ group symmetrically bridges the two uranium fragments. Crystals of $(MeC_5H_4)_4U_2(NPh)_2$ are monoclinic, $P2_1/n$, with a = 14.738 (3) Å, b = 9.933 (2) Å, c = 10.612 (2) Å, β = 102.11 (2)° at 23°C. For Z = 2 (dimers) the calculated density is 2.13 g/cm^3. The structure was refined by full-matrix least-squares to a conventional R factor of 0.029 [1600 data, $F^2 > 2\sigma(F^2)$]. Crystals of $(MeC_5H_4)_4U_2(NSiMe_3)_2$ also are monoclinic, $P2_1/n$, with a = 15.761 (6) Å, b = 9.389 (4) Å, c = 11.052 (4) Å, β = 101.36 (3)° at 23°C. For Z = 2 (dimers) the calculated density is 2.00 g/cm^3. The structure was refined by full-matrix least-squares to a conventional R factor of 0.023 [2544 data, $F^2 > 2\sigma(F^2)$]. Both complexes are dimers in which the two $(MeC_5H_4)_2U$ fragments are bridged by the organoimide group so that an inversion center is located in the center of the U_2N_2 ring. The bridging U-N distances are 2.156 (8) and 2.315 (8) Å in the NPh complex and 2.217 (4) and 2.230 (4) Å in the $NSiMe_3$ complex. 22 references, 3 figures, 5 tables.

4008 Combustion, Pyrolysis, and High-temperature Chemistry

Refer also to citation(s) 31161, 31273, 31399, 31480, 31511, 31528

31579 (AD-A-204161/4/XAB) **Fuels combustion research. Final technical report, 1 October 1985-30 September 1988.** Glassman, I.; Dryer, F.L.; Williams, F.A. Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering. 30 Nov 1988. 47p. Available from NTIS, PC A03/MF A01.

Studies of near and slightly sooting inverse and normal co-flow diffusion flames determined aromatics as the key intermediates to soot formation. The extent of aromatic formation correlated with the earlier Princeton smoke-height test results. The effect of oxygen addition to tightly bound fuels (ethene, ethyne and benzene) in diffusion flames was found to accelerate the pyrolysis and thus the soothing tendency, but not to affect other fuels in the temperature range of soot formation. Flow-reactor experiments determined oxidation kinetic results for the mono- and dialkylated aromatic components of jet fuels. Succinctly, it was found that the alkyl chains are attached initially and in the case of dialkylated compounds not simultaneously. Mechanisms have been presented. Results on boron-slurry droplet combustion were obtained and provided a basis for calculating when droplet disruption would occur. Questions with respect to boron-cloud combustion addressed mechanisms of ignition and combustion in the regime of chemical kinetic control.

31580 (Juel-Spez-464) **Investigation of a newly developed, multistage combustion system.** Jennebach, M. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Dekontamination. Aug 1988. 115p. (In German). Order Number DE89774739/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

The diploma thesis describes elementary practical experiments with a small experimental thermoprocess plant. The experiments were to investigate the full potential as well as the unresolved problems of the KFA thermoprocess. For an extrapolation of the data to a commercial plant, long-term operation of the pilot plant is absolutely indispensable.

31581 (LRAP-68) **Calibration of imaging laser-induced fluorescence measurements in highly absorbing flames: an analytical reconstruction method.** Burden, A.D.; Hertz, H.M. Lund Univ. (Sweden). Dept. of Physics. Jan 1987. 12p. Order Number DE89766901/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

An analytical solution is presented for the reconstruction of spatially resolved species number densities from spatially resolved laser-induced fluorescence measurements when the integrated absorption of the laser light is known. The stability of the solution under the influence of experimental noise and uncertain zero level is discussed. The iterative reconstruction method, which was presented by Hertz and Alden, is analysed from the point of the exact solution and the two methods are compared. (authors).

31582 (RISO-R-545) **Analysis of low-pressure gas-phase pyrolytic reactions by mass spectrometric techniques.** Carlsen, L. Risoe National Lab., Roskilde (Denmark). Jan 1989. 248p. Order Number DE89776151/JAW. Available from NTIS (US Sales Only), PC A11;3.

The report is divided into seven chapters: Chapter 1 gives a short introduction to applications of pyrolysis techniques in different areas of chemical research. Chapter 2 is devoted to the application of mass spectrometric techniques for the analysis of gas-phase reactions. The applicability of field ionization and collision activation mass spectrometry is illustrated by studies on isomerization reactions of carboxylic acid esters and the thermal decomposition of 1,2-oxathiolane. The importance of reference structures is discussed. Chapter 3 gives details on the sample/inlet systems applicable to the pyrolysismass spectrometry system. Chapter 4 discusses the low-pressure pyrolysis reaction, with special emphasis on reactors based on the inductive heating principle. The temperature control of the reactors is discussed in terms of a "multitemperature" filament, as the basis for the concept of Pulse Pyrolysis. The influence of surface composition on the course of reaction is discussed, advocating for the application of gold coated surfaces to minimize surface-promoted reactions. Chapter 5 deals with low-pressure gas-kinetics on the basis of an empirical "effective temperature" approach. Chapter 6 gives a short summary of the main achievements, which are the basis for the present report and Chapter 7 is the reference list. A Danish summary and 18 appendices, consisting of previously published papers in the period 1980-1986 are included as separate sections. (author) 34 ills., 87 refs.

31583 (SAND-88-1296C) **Modeling thermal-mechanical processes associated with the initiation and combustion of granular energetic materials.** Baer, M.R.; Nunziato, J.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890661-5: 3. international symposium on behavior of media under high dynamic pressures, La Grande Motte, France, 5-9 Jun 1989). Order Number DE89007145/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, we describe a reactive multiphase flow model for the initiation and compressive combustion of dynamically compacted granular energetic materials. Numerical solutions of the reactive multiphase flow equations are obtained for various cases of dynamic compaction. Constitutive relationships of this description are determined for the granular explosive HMX and for nitrocellulose- based ball propellants. At low impact velocities, loading produces compaction without subsequent reaction. Calculations of compaction wave speed and compaction density are in good agreement with experimental observations. Compaction-induced combustion is observed for conditions of higher impact loading. A global reaction model is formulated using experimental time-to-reaction data and calculations of the initiation and combustion reveal detailed wave structures of the compaction and flame spread near the threshold to deflagration to detonation transition (DDT). Predictions of the reactive one-dimensional wave fields compare favorably to experimental observations. 17 refs., 10 figs., 1 tab.

31584 (STEV-FBT-89-19) **Gas composition of the freeboard gas in a fluidized bed boiler.** Karlsson, M. Statens Energiverk, Stockholm (Sweden). Mar 1988. 30p. (In Swedish). Order Number DE89766889/JAW. Available from NTIS (US Sales Only), PC A03;3.

Measurements of the composition of the freeboard gas in a 16 MW fluidised bed boiler have been carried out. The results can be summarized thus: * The concentration of nitrogen oxide is rather even over the cross-section of the boiler (10 m/sup 2/). It decreases from the bed to the exit of the freeboard. * The concentration of oxygen is irregular over the cross-section. There is, however, no evident decay in oxygen concentration in the vicinity of the fuel feed. * The concentration of carbon monoxide is much larger in the vicinity of the fuel feed than in other parts of the cross-section of the freeboard. It decays rapidly with height above the bed. * The concentration of sulphur dioxide is somewhat higher in the vicinity of the fuel feed than in other locations in the cross-section. There is no evident decay in the concentration with height over the bed.

31585 Thermal decomposition of methyl nitrite: kinetic modeling of detailed product measurements by gas-liquid chromatography and Fourier transform infrared spectroscopy. He, Y. (Catholic Univ. of America, Washington, DC (USA)); Sanders, W.A.; Lin, M.C. *Journal of Physical Chemistry (USA),* 92(19): 5474-5481 (22 Sep 1988). DOE Contract FG05-85ER13373.

The thermal decomposition of CH_3ONO was studied in a static reactor at temperatures in the range 450-520 K. Stable products were analyzed by FTIR and gas-liquid chromatography to yield concentration-time profiles as functions of temperature and pressure. The species monitored included CH_3ONO, CH_2O, CH_3OH, NO, N_2O, and CO. The experimental data were kinetically modeled with the aid of Rice-Ramsperger-Kassel-Marcus (RRKM) calculations for pressure-dependent rate constants. The key reactions of this mechanism are the following: $CH_3ONO \rightarrow CH_3O + NO$ (1); $CH_3ONO \rightarrow CH_2O + HNO$ (2); $CH_3O + NO \rightarrow CH_3ONO$ (3); $CH_3O + NO \rightarrow CH_2O + HNO$ (4); $CH_3O + HNO \rightarrow CH_3OH + NO$ (5); $HNO + HNO \rightarrow N_2O + H_2O$ (7). The results showed that the initiation reaction, (1), is clearly pressure dependent in the temperature and pressure ranges investigated. The data are consistent with the value $k_1 = 10^{15.3\pm0.30}$ exp((-38,700 $\pm$ 400)/RT) s^{-1} at 710 Torr of He and with the extrapolated high-pressure rate constant $k_1^{\infty} = 10^{16.01\pm0.30}$ exp((-39,600 $\pm$ 400)/RT)s^{-1}. The rate constant ration k_4/k_3 for channels 3 and 4 was also found to depend on both temperature and pressure. At 710 Torr, $k_3 = 10^{12.96\pm0.30}$ exp((0 $\pm$ 200)/RT) and $k_4 = 10^{12.92\pm0.30}$ exp((-2050 $\pm$200)/RT), both in units of cm^3/(mol s). Kinetic modeling of CH_3OH and N_2OH formation over the entire range of temperatures and pressures investigated

here yielded $k_5 = 10^{13.5\pm0.4}$ exp((0 ± 400)/RT) and $k_7 = 10^{8.93\pm0.30}$ exp ((-3100 ± 300)/RT) cm^3/mol s.

42 ENGINEERING

Refer also to citation(s) 30990, 32965

31586 (UCID–21646) **Technical Abstracts, 1988.** Kotowski, M. (ed.). Lawrence Livermore National Lab., CA (USA). 1 May 1989. 69p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012811/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This document is a compilation of the abstracts from unclassified documents published by Mechanical Engineering at Lawrence Livermore National Laboratory (LLNL) during the calendar year 1988. Many abstracts summarize work completed and published in report form. These are UCRL-90,000 and 100,000 series documents, which include the full text of articles to be published in journals and of papers to be presented at meetings, and UCID reports, which are informal documents. Not all UCIDs contain abstracts: short summaries were generated when abstracts were not included. Technical Abstracts also provides brief descriptions of those documents assigned to the MISC (miscellaneous) category. These are generally viewgraphs or photographs presented at meetings. The abstracts cover the broad range of technologies within Mechanical Engineering and are grouped by the principal author's division. An eighth category is devoted to abstracts presented at the CUBE symposium sponsored jointly by LLNL, Los Alamos National Laboratory, and Sandia Laboratories. Within these areas, abstracts are listed numerically. An author index and title index are provided at the back of the book for cross referencing. The publications listed may be obtained by contacting LLNL's TID library or the National Technical Information Service, US Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161. Further information may be obtained by contacting the author directly or the persons listed in the introduction of each subject area.

4202 Facilities and Equipment

Refer also to citation(s) 30239, 30438, 30448, 30491, 30494, 30495, 30496, 30598, 30811, 30864, 30875, 30897, 30898, 31206, 31266, 31331, 31656, 31865, 32940, 32942, 32944, 32945, 32948, 32954, 33011

31587 (AERE-R–13215) **Methods for detection of fused alumina powder, used as a tracer aerosol, on air sample filters.** Parker, R.C.; Bull, R.K.; Marshall, M.; Stevens, D.C. UKAEA Harwell Lab. (UK). Environmental and Medical Science Div. Jul 1988. 15p. Available from H.M. Stationery Office, London, price Pound 8.00.

Graded fused aluminia dusts (Aloxite) of mean particle sizes of 6 μm upwards are useful for measuring the effects of particle size on aerosol sampling systems and in dust experiments. Methods are described for the determination of filter loading with Aloxite aerosol using thermoluminescence (TL) and x-ray fluorescence (XRF). The XRF method was found to be almost as precise as direct weighing with a precision microbalance, and presents a useful method of detection where other contaminants are present in the sampled airstream.

31588 (BNL–42275) **Understanding the performance of x-ray mirrors.** Takacs, P.Z. Brookhaven National Lab., Upton, NY (USA). Jan 1989. 23p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8805286–1: Synchrotron radiation in structural biology symposium, Upton, New York, USA, 22-25 May 1988). Order Number DE89012226/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The manufacture of x-ray mirrors is a rather specialized branch of the optical fabrication industry. As those who have had to deal with the procurement of these components well know, there are only a handful of optical companies who supply most of the grazing incidence optics in use at the synchrotron light source facilities in this country. There is relatively little information available of practical use to guide the user through any of the above steps. We have been "forced" to develop our own foundation for assessing the performance of various vendors and determining the quality of the components produced by them. Our approach has been to concentrate on the area of metrology of grazing incidence optics and to develop instruments and techniques that can be used to improve the quality of components delivered to us. The major problem hindering the production of grazing incidence optics is the lack of specialized metrology instrumentation that can be used by the small manufacturing shop to assess the quality of the component under production. We have been engaged over the past several years in developing the theoretical framework and practical measurement techniques to link the metrology to actual performance, providing much-needed feedback to the manufacture and also educating users and manufacturers in the proper understanding of the language of surface figure and finish metrology.

31589 (CEA-CONF–9761) **Optical fibers and sensors for chemistry.** Perez, J.J.; Boisde, G. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif. 1988. 32p. (CONF-8803210–: Technical meeting on on-line analytical control, Cadarache, France, 10-11 Mar 1988). Order Number DE89770503/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The idea of using optical fibers in nuclear environment occurs as soon as 1967, too soon for practical realizations. In 1973 the first glass fibers were made available in Switzerland. From 1973 to 1988 three periods show the development: conception from 1973 to 1978, technique strengthening from 1978 to 1983 and nuclear and non nuclear industrial development since 1983. 45 refs., 27 figs.

31590 (CONF-860905–Vol.1, pp. 624-637) **Evolution of design concepts for remotely maintainable equipment racks.** Peishel, F.L. (Oak Ridge National Lab., TN (USA)); Mouring, R.W.; Schrock, S.L. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. DOE Contract AC05-84OR21400. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

This paper describes the evolution of equipment racks and improvements to these racks for the past 40 years. These racks function as the support for and positioning of process equipment in remotely maintained hot cells. The improvements have evolved relatively slowly primarily because of limitations in the capabilities of remote maintenance equipment. In recent years however, technological advances in electronics and a perceived need have led the Oak Ridge National Laboratory to the development of bridge-mounted servomanipulators that are operated from a remote control station and that have dexterity and maneuverability approaching those of a man within the hostile environment. These advances permit greater flexibility in the layout of equipment, thereby improving maintenance efficiency and plant availability. The conceptual design of a fuel reprocessing facility, which takes full advantage of the increased capabilities of the maintenance equipment, is also described.

31591 (CONF-860905–Vol.1, pp. 656-666) **Manually-operated vertical articulated manipulator developed for investigation of sub-core regions.** Weissburg, J.A.; Jennrich, C. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

The Three Mile Island Unit 2 (TMI-2) accident resulted in a portion of the core fuel material being relocated to the reactor pressure vessel (RPV) lower head region under the core support assembly (CSA) flow divider plate. It was considered important that information concerning the quantity, distribution, and physical properties of the material deposited in the lower head region be determined early in the Recovery Program, long before the damaged fuel was to have been completely removed from the pre-accident nominal core position. Access to this region was limited to several small holes

that penetrated the CSA flange. The holes were inside the RPV at the top of the annular region outside the CSA. Additional smaller holes were available for insertion of lights into the region being investigated. This paper describes the development and features of a long-reach, small-cross section mechanical tool used for TV Camera manipulation and sample retrieval in remote locations in the lower head region of the damaged TMI-2 reactor.

31592 (CONF-860905–Vol.1, pp. 667-673) **Communication in hazardous environments.** Rankin, W.N. (E. I. du Pont de Nemours and Co., Aiken, SC (USA)); Herold, T.R. American Nuclear Society (USA). Fuel Cycle and Waste Management Div.; American Nuclear Society (USA). Niagara-Finger Lakes Section. Jul 1987. From International meeting on low, intermediate and high level waste management - decontamination and decommissioning; Niagara Falls, New York, USA; 14-18 Sep 1986. In *Spectrum '86: Proceedings: Volume 1.* Order Number DE88015081/JAW. Available from NTIS, PC A99/MF A01; 1.

Radios were investigated for use in hazardous environments where protective breathing equipment such as plastic suits and respirators interfere with communication. A radio system, manufactured by Communications-Applied Technology (C-AT), was identified that was designed specifically for hazardous environment communications. This equipment is used successfully by the US Army and NASA. C-AT equipment was evaluated in plantwide applications at the Savannah River Plant (SRP) using temporary frequencies obtained by the Department of Energy - Savannah River (DOE-SR). Radios performed well in all applications, which included a tritium facility, high-level caves, a nuclear reactor building tank farm, and a canyon building interior. Permanent frequencies were obtained by DOE-SR for two complete six-man C-AT systems at SRP. Because of the relatively short range of these systems, replicate systems will cover all applications of this type of equipment plantwide. Twelve radio systems are currently being used successfully in plantwide applications.

31593 (CONF-890309–1) **Attractive levitation for high-speed ground transport with large guideway clearance and alternating-gradient stabilization.** Hull, J.R. Argonne National Lab., IL (USA). 1989. 16p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From INTERMAG: international magnetics conference; Washington, D.C., USA; 28-31 Mar 1989. Order Number DE89013640/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes an attractive levitation concept that results in large guideway clearance and low magnetic drag and requires no feedback for stability. Dynamic stability is achieved by establishing alternating gradients of force, in which the spatial dependence of the attractive force between superconducting coils on the vehicle and iron rails in the guideway is altered by periodic changes in the rail configuration. For a vehicle velocity of 500 km/h, the appropriate lengths for each configuration are in the range of 5 to 40 m, and the guideway clearance is in the range of 50 to 100 mm, depending on the details of the rail and vehicle magnet design. 4 refs., 4 figs.

31594 (CONF-890676–1) **Analysis and control of a three-degree-of-freedom robot platform.** Jansen, J.F.; Kress, R.L. Oak Ridge National Lab., TN (USA). 1989. 11p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 2. international CIRP conference on new manufacturing technology; Cookeville, Tennessee, USA; 1-2 Jun 1989. Order Number DE89006427/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the analysis and design of a robot platform with two drive wheels, each with an independent steering mechanism resulting in three independent degrees of motion. The kinematic and inverse kinematic analyses are derived in detail. An adaptive controller is designed to compensate for large inertial variations and to satisfy the velocity (nonholonomic) constraints. 8 refs., 4 figs.

31595 (DOE/ER/13782–3) **The use of stereo optical flow fields in the determination of three-dimensional motion and stereo correspondence: Progress report, May 1988–April 1989.** Duncan, J.H. Maryland Univ., College Park, MD (USA). Dept. of Mechanical Engineering. May 1989. 45p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER13782. Order Number DE89012518/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the first year of the present two-year grant, a method has been developed that can determine the motion of a stereo-camera platform and the relative three-dimensional position of image features using data from stereo image sequences as input. In the first step of the method, the motion is found from a set of linear equations whose coefficients are averages of functions of the measured positions and velocities of image features. In the second step of the method, the same equations are used with the computed translational velocities to determine the correspondence of features in the left and right images. Separate theories were developed which use the full optical flow as input or the normal flow at contours as input. The theory using the full optical flow was derived for six-component, three-dimensional motions, while the theory for the normal flow was derived for translational motion only. The theories require only that the data in the left and right images come from regions corresponding to objects with the same relative velocity. Thus, in the case of a camera platform moving through a stationary environment these regions include the entire images. The theories have been tested with synthetic image sequences and appear to be quite promising. A stereo camera system for use in the laboratory has just been constructed and will soon be used to test the methods with real images from laboratory scenes. In the following, the theory for motion recovery with the full optical flow data is presented first. This is followed by the theory for the recovery of the translational motion from the normal flow data. A discussion of the determination of stereo correspondence follows. Then the results of experiments with synthetic images are presented and finally the conclusions of the work are given. 15 figs.

31596 (DOE/ER/40306–1) **Liquid helium fluid dynamics studies.** Van Sciver, S.W. Wisconsin Univ., Madison, WI (USA). 1989. 7p. Sponsored by DOE Energy Research. DOE Contract AC02-86ER40306. Order Number DE89013124/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The main focus of the first three year period of this research program was to set up our liquid helium flow facility and begin experiments on the flow of liquid helium within this system. The first task of our experimental program involved the set up and check out of the liquid helium flow facility (LHFF). This facility is the centerpost of our fluid dynamics experiments. The LHFF is designed to allow a variety of experiments which test important helium fluid dynamics behavior on a scale close to that involved in large scale applications. To achieve this goal, we chose a horizontal dewar configuration with a cold bore access on either end. A nominal length of five meters was selected with a sufficiently large inner diameter to allow insertion of various tubing configurations, flow metering devices and heat exchangers. Further, to minimize consumption of liquid helium, the dewar design includes two actively cooled shields; one cooled by LN_2 to 77 K and one at 4.5 K maintained by a closed cycle helium refrigerator. Helium flow is to be provided by a cold centrifugal pump. 4 refs., 2 figs.

31597 (K/CSD/INF–88/20) **HTAS2: A three-dimensional transient shipping cask analysis tool.** Wendel, M.W.; Giles, G.E. Oak Ridge Gaseous Diffusion Plant, TN (USA). 1989. 10p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OT21400. (CONF-890631–3: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89011148/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Predicting specific thermal behavior of spent fuel assemblies involved in an accident during shipping is difficult because of the geometric complexity typical of the shipping casks. Models range from a simple expression like the Wooton-Epstein correlation (described by Bucholz, 1983) to detailed finite difference or finite element calculations. Certainly, with enough computer resources and manpower, any given cask arrangement can be accurately analyzed for laminar conditions. However, the cost of such an effort would be prohibitive. Developing an analytical tool thus entails reaching a compromise between accuracy and speed and economy. The Heat Transfer Analysis Sequence 2 (HTAS2) program is being developed

for the United States Nuclear Regulatory Commission for the standard safety analysis of nuclear fuel shipping containers (casks) during transport. HTAS2 is intended for use as a driver module in the Standardized Computer Analyses for Licensing Evaluation (SCALE) system (US NRC 1984). As a part of the HTAS2 analysis, an additional SCALE module WHOCAM (WHOle CAsk Model) is also being developed. HTAS2 involves a three-dimensional model of the cask and its internals that accounts for radiation and conduction within the enclosed fuel assemblies and partitioning basket. It is an extension of its two-dimensional predecessor, HTAS1.

31598 (LA-UR–89-1685) **A combined thermal/epithermal neutron interrogation device to assay fissile materials in large containers.** Coop, K.L. Los Alamos National Lab., NM (USA). 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890565–2: 11. annual ESARDA symposium on safeguards and nuclear materials management, , Luxembourg, 30 May - 1 jun 1989). Order Number DE89013443/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We used Monte Carlo techniques to investigate the neutronic properties of a device designed to interrogate large waste containers with both thermal and epithermal neutrons. The interrogating spectrum is obtained by gradually slowing down neutrons from a pulsed source. Shortly after the pulse, the neutrons are predominantly at epithermal energies, becoming completely thermalized at later times. We calculated the effects of using different moderating materials, cavity sizes, and container matrices on the interrogating flux. Such a device could detect "lumpy" or cadmium-shielded uranium in non-hydrogenous matrices and could provide assays of finely divided fissile materials, regardless of hydrogen content. 6 refs., 6 figs., 3 tabs.

31599 (LBL–25735) **Cryogenic techniques for large superconducting magnets in space.** Green, M.A. Lawrence Berkeley Lab., CA (USA). Dec 1988. 23p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8807123–2: Space cryogenics workshop, Frascati, Italy, 18-19 Jul 1988). Order Number DE89013431/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A large superconducting magnet is proposed for use in a particle astrophysics experiment, ASTROMAG, which is to be mounted on the United States Space Station. This experiment will have a two-coil superconducting magnet with coils which are 1.3 to 1.7 meters in diameter. The two-coil magnet will have zero net magnetic dipole moment. The field 15 meters from the magnet will approach earth's field in low earth orbit. The issue of high Tc superconductor will be discussed in the paper. The reasons for using conventional niobium-titanium superconductor cooled with superfluid helium will be presented. Since the purpose of the magnet is to do particle astrophysics, the superconducting coils must be located close to the charged particle detectors. The trade off between the particle physics possible and the cryogenic insulation around the coils is discussed. As a result, the ASTROMAG magnet coils will be operated outside of the superfluid helium storage tank. The fountain effect pumping system which will be used to cool the coil is described in the report. Two methods for extending the operating life of the superfluid helium dewar are discussed. These include: operation with a third shield cooled to 90 K with a sterling cycle cryocooler, and a hybrid cryogenic system where there are three hydrogen-cooled shields and cryostat support heat intercept points. Both of these methods will extend the ASTROMAG cryogenic operating life from 2 years to almost 4 years. 14 refs., 8 figs., 4 tabs.

31600 (OEVS-Mitteilung–1988, pp. 153-157) **Gamma shielding by buildings.** Meckbach, R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz); Jacob, P.; Paretzke, H.G. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Shielding of gammas from deposited activity by different building types is calculated by the Monte Carlo method. The contributions of the individual deposition surfaces to the kerma are considered separately. Kerma reduction factors for different positions within and outside the buildings, different source energies, deposition types and urban environments of the buildings are given. 3 refs., 2 figs., 6 tabs.

31601 (PB–89-860209/XAB) **Chemical and biological warfare: protection, decontamination, and disposal. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 200p. Available from NTISPC N01/MF N01.

Supersedes PB–88-866033.

This bibliography contains citations concerning the means to defend against chemical and biological agents used in military operations, and to eliminate the effects of such agents on personnel, equipment and grounds. Protection is accomplished through protective clothing and masks, and in buildings and shelters through filtration. Elimination of effects includes decontamination and removal of the agents from clothing, equipment, buildings, grounds, and water, using chemical deactivation, incineration, and controlled disposal of material in injection wells and ocean dumping. Other published searches in this series cover chemical warfare detection, defoliants, general studies, biochemistry and therapy, and biology, chemistry and toxicology associated with chemical warfare agents. (This updated bibliography contains 358 citations, 20 of which are new entries to the previous edition.)

31602 (PB–89-860431/XAB) **Superconducting magnetic energy storage (SMES). January 1972-April 1989 (Citations from the NTIS database). Report for January 1972-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 63p. Available from NTISPC N01/MF N01.

Supersedes PB–88-859103.

This bibliography contains citations concerning the techchnology and utilization of superconducting magnetic energy storage (SMES). The design, analysis, evaluation, and operation of SMES systems and equipment are discussed. Topics include utility scale SMES plants, SMES for transmission-line stabilization, design and protection of superconducting magnets and coils, computer controlled SMES systems, and fusion power reactors. (This updated bibliography contains 116 citations, 10 of which are new entries to the previous edition.)

31603 (SAND–88-2115C) **Coupling of the boundary element method with an integral momentum boundary-layer technique to calculate forces and moments on three-dimensional bodies.** Hailey, C.E.; Ingber, M.S.; Tadios, E.L. Sandia National Labs., Albuquerque, NM (USA). 1989. 20p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890677–1: 4. international conference on boundary elements, Windsor, Canada, 6-8 Jun 1989). Order Number DE89006328/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The direct boundary element method is used to calculate the potential flow about bodies of complex geometry in a uniform stream at arbitrary angles of attack. The solution makes use of the double-node concept to improve the quality of the solution in regions with corners and reentrant boundaries. The boundary element method is coupled to an integral momentum boundary-layer solution which accounts for laminar and turbulent boundary layers and the effects of surface roughness. Axial force predictions are compared with experimental data for several shapes and show good agreement. Pitching moment and normal force calculations on axisymmetric and three-dimensional bodies also show agreement with experiment for small angles of attack. 12 refs., 7 figs., 1 tab.

31604 (SAND–88-2287C) **Dynamic fracture toughness measurements of ferritic ductile cast iron.** Salzbrenner, R.; Sorenson, K.B. Sandia National Labs., Albuquerque, NM (USA). 1989. 16p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–2: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89009833/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Fracture toughness testing of ductile cast iron (DCI) at elevated loading rates has been performed at Sandia. The intent of the test

program was to generate rigorously measured dynamic fracture toughness data in order to enhance the DCI material property data base and to evaluate the effect of rate on the upper-shelf fracture toughness. The test requirements outlined in the ASTM Standard Test Method for J_{Ic}, A Measure of Fracture Toughness (E 813-87) were adapted to elevated loading rates in a manner which allowed the inherent rigor of this test method to be maintained. The actual measurements were performed on compact tension specimens using a closed-loop servo-hydraulic test frame with special fixturing to enhance test control. The DCI alloy examined was a high quality casting of the type used in European-produced casks (i.e., it had a fully ferritic matrix, with only Type I and II graphite nodules). The test results show that there is essentially no effect of loading rate on the upper-shelf fracture toughness over the range tested. The current results are in contrast to other reports which suggest that there is a decrease in the upper-shelf toughness as the loading rate is raised above a certain level. 11 refs., 4 figs.

31605 (SAND–88-2341C) **Alternatives for implementing burnup credit in the design and operation of spent fuel transport casks.** Sanders, T.L.; Lake, W.H. Sandia National Labs., Albuquerque, NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–17: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013594/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

It is possible to develop an optimal strategy for implementing burnup credit in spent fuel transport casks. For transport, the relative risk is rapidly reduced if additional pre-transport controls such as a cavity dryness verifications are conducted prior to transport. Some other operational and design features that could be incorporated into a burnup credit cask strategy are listed. These examples represent many of the system features and alternatives already available for use in developing a broadly based criticality safety strategy for implementing burnup credit in the design and operation of spent fuel transport casks. 4 refs., 1 tab.

31606 (SAND–88-2827C) **A source term methodology for spent fuel cask containment evaluations.** Sanders, T.L.; Einziger, R.E.; Jordan, H.; Malinauskas, A.P. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Nuclear Energy. DOE Contract AC04-76DP00789. (CONF-890631–9: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012569/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Our source term objective is to develop methodologies for defining C_N and C_A for all releasable activity associated with spent fuel. It is important to note that our intent is to develop effective methods to assure compliance with the regulations pertaining to containment, and to have a sound, comprehensive technical basis for those methods. Our goals are to provide a consistent and well documented approach to demonstrating containment compliance, and to assure that the result of the approach minimizes exposure to the general public and the radiation worker population to the extent reasonably possible. 5 refs., 1 fig.

31607 (SAND–89-0157C) **Direct phase estimation from phase differences using fast elliptic PDE [partial differential equation] solvers.** Ghiglia, D.C.; Romero, L.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890679–2: Optical Society of America signal recovery synthesis III, Cape Cod, Massachusetts, USA, 14-16 Jun 1989). Order Number DE89007085/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Obtaining robust phase estimates from phase differences is a problem common to several areas of importance to the optics and signal processing community. Specific areas of application include speckle imaging and interferometry, adaptive optics, compensated imaging, and coherent imaging such as synthetic-aperture radar. The purpose of this paper is to relate the equations describing the phase estimation problem to the general form of elliptic partial differential equations, and illustrate results of reconstructions on large M by N grids using existing, published, and readily available Fortran subroutines. 15 refs., 2 figs.

31608 (SAND–89-0411C) **Two-dimensional phase correction of synthetic aperture radar imagery.** Ghiglia, D.C.; Mastin, G.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890679–1: Optical Society of America signal recovery synthesis III, Cape Cod, Massachusetts, USA, 14-16 Jun 1989). Order Number DE89007086/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A two-dimensional synthetic aperture radar (SAR) phase correction algorithm is described as a natural extension of a one-dimensional technique developed previously. It embodies many similarities to phase gradient speckle imaging and incorporates improvements in phase estimation. Diffraction limited performance has been obtained on actual SAR imagery regardless of scene content or phase error structure. The algorithm is computationally efficient, robust, and easily implemented on a general purpose computer or special purpose hardware. 13 refs., 1 fig.

31609 (SAND–89-0671) **Feasibility study for a periodic downhole seismic source.** Hills, R.G.; Hardee, H.C. Sandia National Labs., Albuquerque, NM (USA). May 1989. 79p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE89012813/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Sandia downhole seismic source produces vertically polarized shear waves of variable frequency. While the source has been successfully tested in the field, the practicality of the source for reservoir characterization has not been established. The principal question is whether sufficient power can be supplied to the source through practical means so that sufficient energy output can be maintained. Here we investigate the feasibility of several schemes to provide power to the Sandia downhole seismic source. 4 refs., 5 figs., 5 tabs.

31610 (SAND–89-0914C) **In-service analysis of cask contamination weeping.** Bennett, P.C.; Teer, B.; Mason, M.; Lester, K.; Paquin, P.; Shamkhani, H. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–12: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89013583/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Spent fuel transportation casks have arrived at final destinations with removable surface contamination levels in excess of regulatory limits, although pretransport surveys indicated removable contamination levels were well below these limits. This rise in removable contamination is called weeping. Weeping, also known as sweating, is the transformation of fixed radioactive particulates on an exterior surface of a transport cask to a removable state, some time after the cask has been removed from a spent fuel pool and decontaminated. The weeping phenomenon is countered by time-consuming operational constraints and procedures which have a significant, adverse impact on cask turnaround times and occupational exposures at originating facilities. Furthermore, though not a significant health hazard, the arrival of a weeping cask results in negative public perceptions that are inconsistent with industry and regulatory goals. The objectives in resolving the technical issue of weeping are to identify specific causes of the weeping phenomenon, then to implement new cask design requirements and supporting operational procedures which will limit or inhibit the accumulation, retention, and in-transit conversion of fixed surface contamination. Benefits of finding a solution to weeping therefore include: reduced contamination of casks; improved decontamination techniques; reduced occupational exposure; and reduced cask turn-around times. Such objectives will require an understanding of the physical processes and the determination of related parameters which contribute to the weeping phenomenon. 4 refs., 6 figs., 2 tabs.

31611 (SAND–89-0923C) **Standard thermal problem set.** Glass, R.E.; Burgess, M.; Livesey, E.; Geoffrey, J.; Bourdon, S.; Mennerdahl, D.; Cherubini, A.; Giambuzzi, S.; Nagel, P. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by

DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–6: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89011885/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Beginning in April 1985, a working group on heat transfer met under the auspices of the Organization for Economic Cooperation and Development's Committee on Reactor Safety to define a standard problem set which could be used to benchmark codes used to predict cask thermal response. The problem definitions and solutions which resulted from these meetings as described in "Standard Thermal Problem Set for the Evaluation of Heat Transfer Codes Used in the Assessment of Transportation Packages," R.E. Glass, et al., Sandia National Laboratories, 1988 are summarized in this paper. The problems that were defined address each of the major heat transfer mechanisms (conduction, convection, and radiation) that occur in a cask both during normal transport and as a result of the all- engulfing fire scenario. The problems were kept geometrically simple to minimize the resources required to obtain a solution while still addressing actual phenomena. This has resulted in a set of one- and two-dimensional problems. The solutions to this problem set include closed form analytical solutions, experimental data, and consensus of numerical solutions. For each problem the range of numerical solutions are presented. 1 ref., 4 figs., 2 tabs.

31612 (SAND–89-0938C) **Impact testing and analysis for structural code benchmarking.** Glass, R.E. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–5: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89011884/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sandia National Laboratories, in cooperation with industry and other national laboratories, has been benchmarking computer codes ("Structural Code Benchmarking for the Analysis of Impact Response of Nuclear Material Shipping Cask," R.E. Glass, Sandia National Laboratories, 1985; "Sample Problem Manual for Benchmarking of Cask Analysis Codes," R.E. Glass, Sandia National Laboratories, 1988; "Standard Thermal Problem Set for the Evaluation of Heat Transfer Codes Used in the Assessment of Transportation Packages, R.E. Glass, et al., Sandia National Laboratories, 1988) used to predict the structural, thermal, criticality, and shielding behavior of radioactive materials packages. The first step in the benchmarking of the codes was to develop standard problem sets and to compare the results from several codes and users. This step for structural analysis codes has been completed as described in "Structural Code Benchmarking for the Analysis of Impact Response of Nuclear Material Shipping Casks," R.E. Glass, Sandia National Laboratories, 1985. The problem set is shown in Fig. 1. This problem set exercised the ability of the codes to predict the response to end (axisymmetric) and side (plane strain) impacts with both elastic and elastic/plastic materials. The results from these problems showed that there is good agreement in predicting elastic response. Significant differences occurred in predicting strains for the elastic/plastic models. An example of the variation in predicting plastic behavior is given, which shows the hoop strain as a function of time at the impacting end of Model B. These differences in predicting plastic strains demonstrated a need for benchmark data for a cask-like problem. 6 refs., 5 figs.

31613 (SAND–89-1222C) **Dynamics and static behavior of metal gussets in cask impact limiters.** Attaway, S.W.; Yoshimura, H.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–4: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89011879/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Static and dynamic analyses of an impact limiter for a spent fuel cask have been performed using the finite element analysis code PRONTO2D (Taylor and Flanagan, 1987). The impact limiter contained wood as the energy absorbing material, with the wood confined by a cylindrical metal outer skin and sixteen metal stiffeners (gussets). The object of these analyses was to determine how the wood interacts with the metal stiffeners and to determine if the impact limiter would behave differently under static versus dynamic loading conditions. Originally, the metal gusset strength was assumed to be limited by the elastic buckling load. Further analysis showed that the gusset strength was not limited to the elastic buckling load and that each gusset contributed significantly to the impact limiter's strength. The current analyses investigated the strength of a flat plate or gusset used in impact limiter systems. 3 refs., 6 figs.

31614 (SAND–89-1223C) **Local isotropic/global orthotropic finite element technique for modeling the crush of wood in impact limiters.** Attaway, S.W.; Yoshimura, H.R. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890631–8: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89012571/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Wood is often used as the energy absorbing material in impact limiters, because it begins to crush at low strains, then maintains a near constant crush stress up to nearly 60 percent volume reduction, and there "locks up." Hill has performed tests that show how wood is one of the best absorbers of energy per pound. However, wood's orthotropic behavior for large crush is difficult to model. In the past, analysts have used isotropic foam-like material models for modeling wood. A new finite element technique is presented in this paper that gives a better model of wood crush than the model currently in use. The orthotropic technique is based on locally isotropic, but globally orthotropic (LIGO) assumptions in which alternating layers of hard and soft crushable material are used. Each layer is isotropic; however, by alternating hard and soft thin layer, the resulting global behavior is orthotropic. In the remainder of this paper, the new technique for modeling orthotropic wood crush will be presented. The model is used to predict the crush behavior for different grain orientations of a 5 x 5 inch sample of balsa wood. As an example problem, an impact limiter containing balsa wood as the crushable material is analyzed using both an isotropic model and the alternating layer model. 9 refs., 7 figs.

31615 (SAND–89-7052C) **Analysis of a probe-metallic sleeve feed system for a rectangular waveguide.** Jarem, J.M. Sandia National Labs., Albuquerque, NM (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890660–6: Institute of Electrical and Electronics Engineers (IEEE) Antennas Propagation Society (AP-S) international symposium, San Jose, California, USA, 26-30 Jun 1989). Order Number DE89006769/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An important set of antenna and microwave problems are the problems of determining the electromagnetic currents and fields which occur when a metallic probe is used to excite a rectangular waveguide and the associated problem of how best to tune the above probe in order that the input impedance of the probe is matched to the coaxial cable feed of the system. The above problems are of interest in the areas of phased arrays, excitation of slotted antennas or any area where rectangular waveguides are to be excited. The present paper will be concerned with the second problem mentioned above, namely the problem of how to tune a probe in a rectangular waveguide. The tuning will be accomplished by surrounding the rectangular waveguide probe with a metallic sleeve. A metallic sleeve is used to tune the feed system because the dimensions and position of the sleeve provide three convenient parameters h_1, h_2 and r_s which may be used to vary the input impedance of the overall system. 2 refs., 1 fig., 2 tabs.

31616 (STU-I–671) **Heat pump - a technical system in progress.** Raldow, W. Swedish National Board for Technical Development, Stockholm (Sweden). Jun 1988. 165p. (In Swedish). Order Number DE89766894/JAW. Available from NTIS (US Sales Only), PC A08/MF A01;1.

The report comprises three main parts. In the first part five experts present the state-of-the art within the heat pump technology. System questions are thoroughly considered. The second part describes heat pump installations in industry. The catalogue which presents only the most important information includes 50 installations. The last part describes briefly a number of research projects. (O.S.).

31617 (UCID–21733) **Program CICC, flow and heat transfer in cable-in-conduit conductors: Equations and verification.** Wong, R.L. Lawrence Livermore National Lab., CA (USA). 22 May 1989. 52p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE89013379/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Computer program CICC has been written for use in the thermo-fluids design of the cryogenic superconducting magnets to be used in the International Thermonuclear Experimental Reactor (ITER). These magnets utilize forced-flow, helium-cooled, cable-in-conduit conductors (CICC). Due to conductor movement caused by the high magnetic forces, these superconductors can develop normal zones that generate electrical resistance heat. Program CICC models the transient thermodynamic and fluid-dynamic system response after the appearance of a normal zone in the superconductor. The computational algorithm couples a one-dimensional compressible pipe flow model (including flow choking) with two-dimensional axisymmetric heat-conduction models of the superconductor cable, the conduit, and the epoxy conduit insulation. NBS[asterisk] helium properties are used. The model is verified by comparison with measured temperature and pressure profiles from thermal expulsion experiments. 37 refs., 12 figs.

31618 (UCRL–21192) **Structural engineering, mechanics and materials: Final report.** Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley, CA (USA). Dept. of Civil Engineering. 1988. 69p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (UCB/SEMM–88/15;UCB/SEMM–88/16;UCB/SEMM–8817). Order Number DE89012322/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report on structural engineering, mechanics and materials is divided into three parts: a discussion on using Lanczos vectors and Ritz vectors for computing dynamic responses: solution of viscously damped linear systems using a finite element displacement formulation; and vibration analysis of fluid-solid systems using a finite element displacement formulation. (JF)

31619 (UCRL–21192, pp. 26, Paper 3) **Vibration analysis of fluid-solid systems using a finite element displacement formulation: Final report, Part III. .** Chen, H.C. (California Univ., Berkeley, CA (USA). Dept. of Civil Engineering); Taylor, R.L. Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley, CA (USA). Dept. of Civil Engineering. Sep 1988. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (UCB/SEMM–88/17). In *Structural engineering, mechanics and materials: Final report.* Order Number DE89012322/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

This report presents a finite element solution for the vibration interaction between an inviscid fluid and a solid. The equation of motion governing the inviscid fluid is expressed in terms of the displacements. This ensures that compatibility and equilibrium will be satisfied automatically along the interface of the coupled systems. To suppress circulation modes with non-zero energy, reduced integration is used when computing the element stiffness matrix contributed by the fluid. In addition, a projection is used on the element mass matrix in order to remove the spurious modes which result from the use of reduced integration. Numerical examples for both fluid and coupled fluid-solid systems are performed and the results are shown. 11 refs., 6 figs., 4 tabs.

31620 (UCRL–21192, pp. 15, Paper 1) **A discussion on using Lanczos vectors and Ritz vectors for computing dynamic responses: Final report, Part I. .** Chen, H.C. (California Univ., Berkeley, CA (USA). Dept. of Civil Engineering); Taylor, R.L. Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley, CA (USA). Dept. of Civil Engineering. Aug 1988. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (UCB/SEMM–88/15). In *Structural engineering, mechanics and materials: Final report.* Order Number DE89012322/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

The Lanczos vectors and the Ritz vectors have been used for computing the dynamic response of linear structures. Although the procedures of using these two sets of vectors appear similar to the procedure of using the eigenvectors to find an approximate solution, the fundamental mechanisms of the three are different. We compare the three sets of vectors in detail to show some of the important differences in the hope that this comparison will be helpful to the use of the Lanczos vectors or the Ritz vectors for computing dynamic responses. 7 refs.

31621 (UCRL–21192, pp. 24, Paper 2) **Solution of viscously damped linear systems using a set of load-dependent vectors: Final report, Part II. .** Chen, H.C. (California Univ., Berkeley, CA (USA). Dept. of Civil Engineering); Taylor, R.L. Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley, CA (USA). Dept. of Civil Engineering. Aug 1988. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (UCB/SEMM–88/16). In *Structural engineering, mechanics and materials: Final report.* Order Number DE89012322/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

This paper considers a solution method for viscously damped linear structural systems which are subjected to transient loading. The equations of motion of such systems are written in a first-order form. A Krylov subspace is generated using the damped dynamic matrix and the static deflection from the first-order form of the equations of motion. Two convenient bases, Lanczos vectors and Ritz vectors, are constructed from the Krylov subspace. An approximate solution is then obtained by superposition of the Lanczos vectors or the Ritz vectors. In contrast to the traditional mode superposition method using complex eigenvectors, the Lanczos vectors or the Ritz vectors are less expensive to generate than the complex eigenvectors, yet yield comparable accuracy. In addition, there is no need for a static correction since the static deflection is already contained in the Krylov subspace. Numerical examples are presented to show the potential of using the Ritz vectors to compute responses of damped dynamic systems. 11 refs., 6 figs.

31622 (UCRL–53924) **Sensors for in situ monitoring of elastic properties.** Olness, D. Lawrence Livermore National Lab., CA (USA). 11 Apr 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012795/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Preliminary experiments have been carried out to examine an invention for in situ monitoring of elasticity. The elasticity monitor consists of a piezoelectric material placed in contact with an elastomer to form an oscillating system. Monitoring the resonant frequency, amplitude, or "Q" value of this system provides a measure of elasticity of the elastomer. The experiments are described and their results and implications discussed. 7 refs., 7 figs.

31623 (UCRL–98804) **Capabilities and some applications of the LLNL 100-kV electric gun.** Osher, J.E.; Gathers, G.R.; Chau, H.H.; Weingart, R.C. Lawrence Livermore National Lab., CA (USA). 5 Jun 1989. 9p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. (CONF-890661–4: 3. international symposium on behavior of media under high dynamic pressures, La Grande Motte, France, 5-9 Jun 1989). Order Number DE89006747/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The LLNL 100-kV electric gun is an experimental device for launching thin flyer plates at velocities as high as 20 km/s to study impact damage and shock-wave physics. The hypervelocity impact studies reported here include a damage study of spalling damage in aluminum, a study of one-dimensional shock-wave attenuation in materials, use of the well-characterized one-dimensional shock waves for equation-of-state measurements in various materials, and use of thin flyer plates at velocities up to 18 km/s to produce reverse ballistic impact on target objects such as rods to measure damage and fragmentation. Our studies include both experimental results and correlation with numerical calculations using a code such as DYNA2D. 2 refs., 9 figs.

31624 A new glove-box system for a high-pressure tritium pump. Wilson, S.W. (Lawrence Livermore National Lab., Livermore, CA (US)); Borree, R.J.; Chambers, D.I.; Chang, Y.; Merrill, J.T.; Souers, P.C.; Wiggins, R.K. *Fusion Technology (USA),* 14(2): 1005-1009 (Sep 1988).

A new glove-box system that was designed around a high-pressure tritium pump is described. The system incorporates new containment ideas such as burpler passive pressure controls, valves that can be turned from outside the box, inflatable door

seals, ferro-fluidic motor-shaft seals, and rapid box-to-hood conversion during cryostaging. Currently under construction, the system will contain nine separate section with automatic pressure-balancing and venting systems.

31625 Hot-electron limitation to the sensitivity of the dc superconducting quantum interference device. Wellstood, F. C. (Department of Physics, University of California, Berkeley, California 94720, and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, California 94720(US)); Urbina, C.; Clarke, J. *Applied Physics Letters (USA),* 54(25): 2599-2601 (19 Jun 1989).

The noise energy of conventional thin-film dc superconducting quantuminterference devices (SQUIDs) flattened out as the operating temperature waslowered below 140 mK. We attribute this saturation to the heating of theelectrons in the resistive shunts by the SQUID bias current. This "hot-electroneffect" is a general property of normal metals at low temperatures and arisesfrom the limited rate at which the electrons can transfer energy to phonons. Thetemperature of the electrons, and hence the noise energy of the SQUIDs, wasreduced by a factor of about 3 by attaching large volume "cooling fins" toeach shunt.

4203 Lasers

Refer also to citation(s) 30642, 31179, 31345, 31697, 31711, 32887

31626 (AD-A–204187/9/XAB) **Development of an efficient high-brightness Ti:Al_2O_3 laser amplifier. Final report, 15 August 1987-14 February 1988.** Cullen, D.; Haddad, W.; Boyer, K.; Rhodes, C.K. MCR Technology Corp., Chicago, IL (USA). Apr 1988. 15p. Available from NTIS, PC A03/MF A01.

Ti:Al_2O_3 represents an exciting new material with application to many areas including atmospheric research, laser radar, and spectroscopy. It is particulary suitable for short-pulse generation, since it has a very large bandwidth. In the context of short wavelength high-brightness sources, MCR Technology Corporation has pursued the development of Ti:Al_2O_3 as a system which can be frequency doubled or tripled to produce high energy picosecond and femtosecond duration pulses at short wavelengths. To data they have demonstrated a flashlamp-excited device capable of 450 mJ output at 750 nm in a 300-nsec pulse. The overall electrical to optical energy conversion was 0.18%. On the basis of this result, it is projected that overall efficiencies greater than 1 - 2% should be achievable in relatively simple and practical configurations.

31627 (AD-A–204225/7/XAB) **High-brightness diode lasers for blue-green applications. Interim technical report, 1 July 1987-31 December 1988.** Mullen, R.A.; Pepper, D.M. Hughes Research Labs., Malibu, CA (USA). Jan 1989. 72p. (HAC-REF-G–2937). Available from NTIS, PC A04/MF A01.

Experimental investigations of the physics of self-pumped photorefractive phase-conjugators were performed. Particular emphasis was placed on studying the properties of backward stimulated photo-refractive scattering (BSPS) conjugators in $BaTiO_3$, and on attempts to demonstrate self-pumped phaseconjugation in GaAs. The phase-conjugate reflectivity of BSPS conjugations in $BaTiO_3$ is shown to be significantly enhanced by the use of feedback. An experimental comparison of three distinctly different geometries for feedback-enhanced backward-stimulated photorefractive scattering (FE-BSPS) is made. In one case, the feedback is found to stabilize the reflectivity, while in the other case, it greatly enhances the peak reflectivity.

31628 (LA-UR–89-1838) **Recent experiments with the free-electron laser at Los Alamos.** Feldman, D.W.; Warren, R.W. Los Alamos National Lab., NM (USA). 1989. 3p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890335–183: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013469/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Improvements in the operational characteristics of the Los Alamos free-electron laser have produced experimental results in reasonable agreement with theory and simulation. The results of these experiments will be described. 16 refs., 5 figs.

31629 (PB–89-859912/XAB) **Laser mirrors. January 1975-August 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1987.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 170p. Available from NTISPC N01/MF N01.

See also PB–89-859920.

This bibliography contains citations concerning manufacturing and applications of laser mirrors. Studies of optical, thermal, and mechanical properties of laser-mirror materials are presented. Laser-mirror coating, cooling, and surface-cleaning techniques are discussed. Laser damage, control devices, and optical losses in laser-mirror systems are also discussed. (This updated bibliography contains 353 citations, none of which are new entries to the previous edition.)

31630 (PB–89-859920/XAB) **Laser mirrors. September 1987-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for September 1987-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 48p. Available from NTISPC N01/MF N01.

Supersedes PB–87-866141. See also PB–89-859912.

This bibliography contains citations concerning manufacturing and applications of laser-mirrors. Studies of optical, thermal, and mechanical properties of laser mirror materials are presented. Laser mirror coating, cooling, and surface-cleaning techniques are discussed. Laser damage, control devices, and optical losses in laser-mirror systems are also discussed. (This updated bibliography contains 62 citations, all of which are new entries to the previous edition.)

31631 (SAND–89-0503C) **Z-pinch modeling at Sandia National Laboratories.** Hussey, T.W.; Matzen, M.K.; Roderick, N.F. Sandia National Labs., Albuquerque, NM (USA). 1989. 19p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8904107–2: 2. international conference on high-density pinches (ICHDP-2), Laguna Beach, California, USA, 26-28 Apr 1989). Order Number DE89013069/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The recent emphasis of the Sandia National Laboratories fast Z-pinch effort has been to utilize an imploding gas puff to produce the pump radiation for a photoionization-pumped soft x-ray laser. Because of their potential for utilizing the cylindrical convergence of a fast Z-pinch, we use hollow, coaxial, cylindrical targets to stagnate the implosion. The kilovolt component of radiation produced by this stagnation is the photoionizing pump source for the lasant material that is inside the cylinder. Such a system requires a detailed understanding of the dynamics of both the target and the imploding gas puff as well as their radiative properties. In recent years at Sandia we have studied a number of aspects of this process theoretically, which we describe here. We have considered large scale length non-uniformities resulting from flaring of the gas puff that lead to nonuniform target closure, and shorter wavelength non-uniformities resulting from the hydromagnetic Rayleigh-Taylor instability. More recently, we have emphasized the profound effect of "radiation collapse" of the imploding annular plasma before it reaches the target. This process, which varies considerably with gas puff material and mass (and, therefore, implosion energy), alters density gradient and radiation preheat during the run-in, greatly affecting target dynamics. In addition, we have developed detailed designs for these central targets, which are found to levy severe requirements on gas puff implosion performance. The feasibility of meeting these requirements which may be ameliorated by increased driver energy, is discussed. 32 refs., 9 figs.

31632 (SAND–89-0953C) **Fission reactor pumped lasers: History and prospects.** McArthur, D.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890406–16: Fifty years with nuclear fission conference, Gaithersburg, Maryland, USA, 25-28 Apr 1989). Order Number DE89010329/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

LASERS/pumping; HISTORICAL ASPECTS; LASERS; PUMPING; REACTORS; FISSION FRAGMENTS; PULSED REACTORS

31633 (UCID–21703) **Absolute intensity, high resolution spectrum of the vortek arc lamp and its spectral match to Nd:YAG bands.** Zapata, L.E. Lawrence Livermore National Lab., CA (USA). 10 May 1989. 13p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE89012807/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A high resolution (1 Å), absolute intensity spectrum from 300 to 900 nm was obtained for a high average power (100 kWe) argon arc-lamp. The high average power is obtained due to innovative technology that cools the inside surface of the lamp envelope by means of a spiraling water jet. The optical output between 200 and 2000 nm was measured by using a calibrated pyroelectric detector and glass color filters, and accounted for 54% of the electrical input. The agron arc-lamp radiated 35% of the electrical power input in the 400 to 900 nm spectral region when a cerium doped quartz envelope was used; furthermore, 37% of this optical power was emitted as line output between 730 and 830 nm, a region well tuned to Nd^{3+}:YAG absorption bands. Lower resolution spectra and fluorescence/transmission measurements of YAG samples were obtained for mixtures of Ar/Kr and Ar/Xe with up to 14% by volume of the heavier species. When the Ar/14%-Kr mixture was used, increased absorption (115%) and net fluorescence (120%) were measured relative to the pure argon arc-lamp. 5 refs., 8 figs., 1 tab.

31634 (UCRL–21203) **Theoretical studies and algorithm development for x-ray lasers: Final report, June 15, 1988–February 15, 1989.** Hagelstein, P.L.; Kaushik, S.; Balents, L.; Hung, J. Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics. 1989. 83p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012624/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report describes the results of research performed for the Lawrence Livermore National Laboratory under LLNL subcontract BO48704 during the period June 15, 1988 through February 15, 1989. As will be elaborated on further in this report, some very important results have been obtained. The development of the preconditioned biconjugate gradient algorithm for the solution of NLTE rate equations is a major result, and offers the possibility of speeding up a major LLNL design code (XRASER) by 25-50% on kinetics-dominated design problems. Although I do not have the current monthly use numbers in hand for XRASER, as of 1986 the savings in computer time from such a speed-up would reach $50K in roughly a month. In this sense, we at MIT and our contacts at LLNL have felt that the development of this algorithm alone is sufficient to satisfy the LLNL end of the present contract. 15 refs.

31635 Reactive ion etching of laser structures. Vawter, G.A. (Sandia National Lab., Albuquerque, NM (US)). v.v of Advanced processing of semiconductor devices II. Craighead, H.G.; Narayan, J. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8803173–: Advanced processing of semiconductor devices II, Newport Beach, California, USA, 17-18 Mar 1988).

In recent years interest in dry-etch processing of laser structures has grown dramatically. Reactive-ion-etching (RIE) has developed from a high resolution pattern transfer technique for silicon integrated circuit processing into a successful method for fabricating the smooth, vertical facets required by double heterostructure (DH) lasers. However, in addition to RIE several other new plasma processes have been developed and applied to the development of dry etched laser structures. This paper reviews the motivations behind this work, provides some examples of recent developments in the field of dry-etching as applied to DH laser structures and attempts to point out some of the problems associated with dry etching of optoelectronic devices.

31636 High-energy laser-assisted imaging through vaporizing aerosols. Zardecki, A. (Theoretical Div., Los Alamos National Lab., Los Alamos, NM (US)); Gerstl, S.A.W. v.v of Optical, infrared, and millimeter wave propagation engineering. Miller, W.B.; Kopeika, N.S. SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1988). (CONF-8804231–: Optical, infrared, and millimeter wave propagation engineering, Orlando, Florida, USA, 5-7 Apr 1988).

The degradation of image quality due to multiple scattering in a turbid medium is analyzed under various conditions of illumination. The emphasis is on the forward-peaked multiple scattering effects, which can adequately be described by the small-angle approximation. In the case of incoherent illumination, the modulation transfer function (MTF) can be given explicitly both in the low- and high-frequency limits. For scattering with smaller degree of anisotropy, the MTF should be computed numerically by considering solutions to the equation of radiative transfer with a line or point source. As the beam power increases, the turbid medium becomes modified by its interactions with the beam, thus affecting the image resolution. In this nonlinear transport regime (flux levels of the order of 10/sup 6/ W/cm/sup 2/and higher) the propagation leads actually to beam narrowing. In the context of the imaging problem, an apparent paradoxical situation–in which the image of a point source narrows down as the high-energy laser (HEL) beam propagates–is discussed.

31637 Optical technique for broadband microwave absorption spectroscopy in aqueous media. Mukherjee, P. (Los Alamos National Lab., Los Alamos, CA (US)); Bigio, I.J.; Gosnell, T.R. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Precise measurements of microwave absorption over a large range of frequencies in aqueous media are difficult to obtain and can result in conflicting results as a consequences of small differences in instrumentation. Traditional methods of microwave spectroscopy that make use of time-domain spectrometers or network analyzer systems provide only indirect measurement of the microwave absorption coefficient because they measure the real and imaginary parts of the dielectric constant, ϵ' and ϵ'', separately. The absorption coefficient must then be calculated from ϵ' and ϵ'' taking into account the geometry (e.g., of the waveguide and mode) among other factors. It has been shown that direct measurement of the microwave absorption coefficient α is possible using phase fluctuation optical heterodyne spectroscopy. Taking advantage of this hybrid optical-microwave technique the authors report on a broadband spectrometer with demonstrated accurate operation from 3 to 20 GHz.

31638 High-pressure Ar-Xe waveguide lasers with microwave discharge excitation. Gordon, C.L. (US Naval Research Lab., Washington, DC (US)); Feldman, B.J.; Christensen, C.P. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Efficient high-power operation of high-pressure Ar-Xe lasers has been reported by several investigators who have used a variety of excitation techniques. High-pressure Ar-Xe devices typically operate with gas mixtures composed of a small amount of xenon in an argon buffer at total pressures of several atmospheres. The laser spectrum is normally dominated by emission at 1.73 μm with efficiencies as high as 5% reported. Other weaker lines at 2.02, 2.62, 2.65 and 3.37 μm usually contribute a few percent of the total power. The authors describe a study of Ar-Xe laser operation using electrodeless microwave excitation and an optical waveguide cavity. A 0.5 x 5-mm rectangular bore borosilicate glass tube 20 cm in length confines the gas mixture and acs as an optical waveguide for the IR laser emission. A 915-MHz microwave generator excites the plasma with pulses that are variable in peak power over the 0-4-kW range and in duration from 0.2 to 20 μs.

31639 Short-pulse intracavity Raman laser. Band, Y.B. (Los Alamos National Lab., Los Alamos, NM (US)); Ackerhalt, J.R.; Krasinski, J.S.; Heller, D.F. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

The authors discuss the physics and design of a new class of tunable duration, short-pulse laser. They describe a unidirectional ring laser containing a medium with gain at the fundamental frequency and a (nearly) copropagating unidirectional ring laser for the Stokes shifted Raman frequency with the intersection of the beams in the

Raman gain medium common to both rings. The laser cavity lengths are adjusted to differ by the amount Δ/so that the cavity round trip times differ by the desired output pulse duration (i.e., Δ/= CT/sub out/). A fundamental pulse and a small Raman seed pulse are injected into the pump and Stokes cavities, respectively. One pulse is delayed relative to the other so they overlap during successive trips through the cavities. When the fundamental pulse overlaps the seed Raman pulse in the Raman medium, the fundamental pulse is converted into Stokes light via stimulated Raman scattering. Gain at the Stokes frequency occurs only during the overlap of the fundamental and Stoke pulses; this occurs for a time duration Δ//c.

31640 Polarization effects in diode-laser-pumped Nd. Esherick, P. (Sandia National Labs., Albuquerque, NM (US)); Owyoung, A. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Applied stress has been reported previously as an effective means to obtain polarized emission in diode-laser-excited monolithic Nd:YAG lasers. In an effort to resolve some discrepancies concerning their polarization behavior, the authors conducted a systematic study of the polarization properties of these devices. Their findings indicate that the polarization of the pump radiation is a more important factor than previously realized in selecting the output polarization of the mini-YAG oscillator. This polarization effect is particularly important in the strain tuned monolithic oscillators, because it provides a means for independently partitioning the available energy between the two orthogonally polarized lasing modes of the birefringent oscillator. The authors also report the rather surprising result that the effect is strongly dependent on the wavelength of the pump radiation. This latter observation suggests the importance of spectral control of the diode-laser pump radiation in realizing well-behaved laser emission.

31641 Spectroscopy of ionic alkali halide excimers excited by laser-produced plasmas. Wisoff, P.J. (Rice Univ., Houston, TX (US)); Frey, L.; Kubodera, S.; Sauerbrey, R. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

The vacuum ultraviolet fluorescence from ionic alkali halide excimer molecules (A/sup 2+/X/sup -/) has been observed in a laser-produced plasma. The emission of C/sub s//sup 2+/F/sup -/ has been previously observed using ion beam excitation. Since the A/sup 2+/X/sup -/state (at –17 eV) represents the second ionization limit of the neutral CsF ground state, the state is not unlike an inner-shell ionized atomic state. Since large populations of core-excited ions have been previously demonstrated from laser-produced plasma excitation; it is plausible that this excitation technique would be suitable for producing ionic alkali halide molecules. Using an alkali halide heat pipe oven coupled to a 0.25-m spectrometer, strong emission from ionic alkali halide vapor in the oven was excited with a laser plasma. The plasma was produced by focusing the 25-ns laser pulses (750 mJ/pulse) from an oscillator-amplifier KrF laser onto a tantalum target located at the center of the oven. The highest laser intensity at the focus used in these experiments was –3 X 10/sup 11/W/cm/sup 2/, corresponding to a square focal spot of 100 μm on a side. A CaF/sub 2/lens was used to concentrate the fluorescence onto the slits of the spectrometer.

31642 Time-resolved absorption spectroscopy of Kr/sub 2/F(4/sup 2/Γ). Greene, D.P. (Los Alamos National Lab., Los Alamos, CA (US)); McCown, A.W. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

The spectroscopic properties of rare gas halide trimers have been under investigation for several years now. These molecules are of interest for their role in the kinetics of rare gas halide excimer lasers. In particular, formation of and absorption by Kr/sub 2/F are important processes in the high-krypton-fraction electron-beam-pumped KrF lasers being investigated as potential ICF drivers. In addition, Kr/sub 2/F absorption and emission are thought to be important in increasing the efficiency of XeF (C → A) lasers. Previous experimental studies of Kr/sub 2/F have used fluorescence suppression and laser-induced fluorescence following trimer absorption to provide cross sections and branching ratio estimates at excimer wavelengths. This technique has recently been extended to other wavelengths using an excimer- or YAG-pumped dye laser. In conjunction with these measurements, it was decided to record directly the continuous absorption spectrum of Kr/sub 2/F in the near-UV region using a pulsed broadband light source.

31643 Cesium laser-excited optical filter. Shay, T.M. (Los Alamos National Lab., Los Alamos, CA (US)). v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Narrow-bandwidth optical sources are readily available. However, tunable narrow-bandwidth wide field-of-view optical filters are not available. The laser-excited optical filters (LEOFs) presented here are in principle tunable narrow-bandwidth wide field-of-view optical filters. These filters can simultaneously provide high resolution (0.001 nm), wide field of view ($\pm 90^0$C), high quantum efficiency, and electrically tunable optical filtering. These devices are ideally suited for extracting/weak narrow-bandwidth signals buried in strong nonresonant optical background radiation. Potential applications of these filters include laser communications, laser radar, detection of Raman radiation, and atomic spectroscopy. Semiconductor lasers have demonstrated output powers of several watts, which can pump filter apertures as large as hundreds of square centimeters. The use of semiconductor lasers as the excitation source for laser-pumped atomic vapor filters makes these filters highly practical. The results of laser power vs realizable quantum efficiency calculations for the 535.18-nm Cs transition and several other Cs transitions are also presented. The 535.18-nm transition of Cs can be used as a filter for the practically important doubled Nd:BEL laser.

31644 Semiconductor laser-diode-pumped solid-state lasers, status and future. Krupke, W.F. (Lawrence Livermore National Lab., Livermore, CA (US)). v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Semiconductor laser diode pumping of solid-state lasers is an idea whose time has come. Early experiments in the 1960s proved the scientific feasibility of diode pumping, but the cryogenically cooled, relatively low-efficiency diodes of the day precluded demonstration of the high-efficiency, power, compactness, and operating life that the concept promises. Since then, the room-temperature efficiency, power, diode packing density, and life of AlGaAs laser diodes have increased spectacularly; largely due to the introduction of MOCVD wafer scale processing of single- and multiple-quantum-well diode structures: single- 100-μm-wide-stripe laser diodes can produce >3-W cw and >8-W quasi-cw (150-μs pulse); centimeter long linear (bar) diode arrays can produce >13-W cw and >130-W quasi-cw; 2-D arrays of stacked bars can produce >3.3-kW/cm/sup 2/quasi-cw; high-power diodes are now approaching wall plug efficiencies of 60%. The recent availability of such high-performance laser diodes and arrays has enabled significant progress toward the full realization of the original vision. This paper presents a snapshot of the status of laser-diode-pumped solid-state lasers, identifies current issues and responses, and outlines future trends and applications.

31645 Observation of anomalous low J-value Stokes and anti-Stokes lines in stimulated rotational Raman scattering over long air paths. Pennington, D.M. (Lawrence Livermore National Lab., Livermore, CA (US)); Henesian, M.A. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

The authors report their recent observations of low J-value Stokes and anti-Stokes lines from stimulated rotational Raman scattering (SRRS) in long air paths with a large Fresnel number beam at a pump wavelength of 1053 nm. The spectral and temporal dynamics

of SRRS is important to our understanding of SRRS as applied to the propagation of large-aperture beams in laser systems for fusion research and in defense applications. An example of this is the proposed implementation of broad bandwidth and spatial incoherence for target irradiation experiments in the field of laser-plasma interactions. Propagation and amplification of laser bandwidths exceeding ±20 cm can seed and possibly amplify the low J-value rotational transition in nitrogen. This can lead to significantly reduced beam quality and divergence comparable to the solid angle of the beam if SRRS growth cannot be controlled. To understand the spectral and temporal dynamics of SRRS, the authors have conducted further experiments using one arm of the Nd:glass Nova laser system at Lawrence Livermore National Laboratory. A spatially uniform linearly polarized section of the 74-cm beam was apodized to 23 cm and down-collimated to 11.5 cm. The beam was propagated over a 75-m air path at atmospheric pressure to a diagnostic station. Spectral measurements were made at the end of the propagation path in both the near field and far field at various intensities. In addition, time-resolved spectra were recorded using a streaked spectrometer to characterize the temporal evolution of the Raman transitions.

31646 B-state excimer production following rare-gas halide trimer absorption. McCown, A.W. (Los Alamos National Lab., Los Alamos, NM (US)); Greene, D.P.; Schloss, J.H.; Eden, J.G. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

The rare-gas halide trimers, and in particular Kr/sub 2/F and Xe/sub 2/Cl, have received a considerable amount of attention recently. In the past year, three separate laboratories have reported measurement of the Kr/sub 2/F(4/sup 2/Γ) absorption cross section at 248 nm, while one of the groups has measured the cross section from 248 to 570 nm using a dye-laser system. However, little attention has been given to determining the product state of the absorption process. It has been assumed that the absorption band terminates at a bound upper level. Experiments were recently reported which suggested that at certain wavelengths, the excimer B state is populated following photodissociation of the associated trimer. A frequency-doubled dye laser has allowed the branching ratio for the formation of the excimer B state following trimer absorption to be measured continuously from 220 to 450 nm. An ArF laser provided the means for two-photon excitation of krypton 6p[3/2]/sub 2/atoms, which ultimately led to the formation of KrF* and Kr/sub 2/F*. The dye laser was triggered at the peak in the Kr/sub 2/F* fluorescence, which occurred ≥60 ns after initiation by the ArF laser. Results of these experiments demonstrate the need for a revision of trimer potential-energy curves to be made.

31647 Fracture mechanisms of solid state slab lasers. Marion, J.E. (Lawrence Livermore National Lab., Livermore, CA (US)). v.v of Fractography of glasses and ceramics. Frechette, V.D.; Varner, J.R. American Ceramic Society Inc., Westerville, OK (1988). (CONF-8608230–: Fractography of glasses and ceramics, Alfred, New York, USA, 3-6 Aug 1986).

Recent solid state laser development for high-average-power output has focused on slab-type geometries to minimize optical distortions. The slabs are heated throughout the bulk by absorption of flashlamp energy, but only their surfaces are cooled, giving rise to a quasi-steady state temperature gradient in which the slab surfaces are in tension. Fracture of these components from surface flaws due to optical fabrication severely limits power output. A number of investigators have informally reported that laser slab failures have occurred at stresses lower than that expected. By using Weibull scaling of fracture data for optically polished glass, this tendency is found to be caused by inappropriate estimates of operating stress. This stress has been based on a mean fracture stress measured on small three-point bend specimens, without regard for size scaling. Here, reasonable operating stresses for large slabs are estimated by a statistical treatment of fracture data using specimens which receive fabrication simultaneous and identical to the slab. Comparing these fracture-stress estimates with failure stresses of large slabs in service illustrates the utility of this approach.

31648 Uses of very high-power free-electron lasers based on electrostatic accelerators. Gover, A. (Science Applications International Corp., McLean, VA (US)); Friedman, A.; Drobot, A. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Free-electron lasers (FELs) have been demonstrated in the last decade in a wide range of operating frequencies ranging from microwaves to visible light. As the technology of FELs has matured, the possibility of high power levels with high efficiency while maintaining both coherence and wavelength tunability has become evident. This property of FELs leads to near-term and futuristic applications, which are compatible with the expected size and weight characteristics of such high-power devices. In reviewing the state of the art of FELs, the authors conclude that FELs based on electrostatic accelerators with energy recovery can fundamentally change the economics of producing coherent radiation over a very broad part of the spectrum. This is particularly true of applications requiring high average power and high efficiency. With a depressed collector energy retrieval scheme, overall wall plug energy conversion efficiencies in excess of 50% are expected to be realizable as is routinely achieved in microwave devices.

31649 Compact diffusion-cooled CO/sub 2/laser. Macken, J. (Lasercraft, Inc., Santa Rosa, CA (US)); Wrench, H.; Samis, M. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Diffusion-cooled CO/sub 2/lasers typically exhibit a maximum output power of 75 W/m. It has been presumed that only convective flowing of the CO/sub 2/laser gas can increase this output power per meter. However, a previously unknown physical effect permits the construction of a new class of diffusion-cooled CO/sub 2/laser which exhibits output powers exceeding 650 W/m of discharge length. This new type of laser incorporates a new discharge stabilization technique to achieve a uniform glow discharge, which is in the shape of a thin flat slab. The discharge is primarily bounded by two flat and parallel electrically insulating surfaces. Typically, the plates are separated by a distance of <7% of the length or width dimensions of the plates. Heat from the discharge is primarily removed by thermal conduction through these surfaces and through metal backing plates to a cooling fluid. This new discharge technology permits laser designers to shape and stabilize discharges in a way not previously possible. For example, uniform annular discharges have also been produced. This technology has possible use in other types of gas laser.

31650 Large-volume high-pressure CO/sub 2/laser for ultrashort pulse amplification. Shimada, T. (Los Alamos National Lab., Los Alamos, NM (US)); Bigio, I.J.; Kurnit, N.A.; Harrison, R.F. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

Since the first demonstration of ultrashort pulse generation (~240 fs) from the CO/sub 2/laser, this short-pulse 10-μm light source is generating more interest in multiphoton excitation in photochemistry, in ultrafast processes in semiconductor materials, and in applications to laser particle acceleration. To increase the energy level of ultrashort pulses, a broad-bandwidth amplifier is required. For this purpose, high-pressure CO/sub 2/amplifiers (>10 atm) are commonly employed to utilize the pressure-broadened bandwidth. However, there are some technical difficulties to aperture scaling of a high-pressure CO/sub 2/laser, such as the structure of high-pressure vessels, the difficulty of obtaining stable discharges, and high-voltage requirements. To overcome these difficulties in scale-up, the authors are developing an amplifier which will utilize a multi-isotopic gas mix at much lower pressure (~4 atm) without losing the wide gain bandwidth of typical single-isotope high-pressure devices. This amplifier is used as a multiple-pass saturated amplifier to reduce the amplitude of the satellite pulses caused by the residual modulation of the gain spectrum. Test results are presented.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 31155

31651 (AD-A–204100/2/XAB) **Small internal waves in two-fluid systems. Technical summary report.** Amick, C.J.; Turner, R.E. Wisconsin Univ., Madison, WI (USA). Center for Mathematical Sciences. Aug 1988. 37p. (CMS-TSR–89-4). Available from NTIS, PC A03/MF A01.

This paper treats travelling waves in a heterogeneous, inviscid, non-diffusive fluid bounded between two horizontal boundaries. The fluid has two incompressible components of different, but constant density and is acted on by gravity. The flow is steady when viewed in a moving reference frame and gives rise to quasilinear elliptic problem with an eigenvalue parameter related to the wave speed. The small amplitude solutions are analyzed using a dynamical systems approach. A center manifold reduction in combination with a conserved quantity for the flow is used to parameterize all 'small solutions of the full elliptic system in terms of solutions of an autonomous first order ordinary differential equation for a principal component of the wave amplitude. The result is a characterization of all small waves, irrotational in each fluid, near the critical speed for the system. They are: solitary waves; surges, connecting distinct conjugate flows at extreme ends of the channel; conjugate flows; and periodic waves. (kr)

31652 (AD-A–204364/4/XAB) **Studies of the structure of attached and separated regions of viscous/inviscid interaction and the effects of combined surface roughness and blowing in high-Reynolds-number hypersonic flows. Final report, 1 August 1985-1 June 1988.** Holden, M.S.; Bergman, R.; Harvey, J.; Duryea, G.; Moselle, J. Calspan UB Research Center, Buffalo, NY (USA). 2 Dec 1988. 141p. (CUBRC–88682). Available from NTIS, PC A07/MF A01.

The first of these 2 studies examined the detailed structure of the hypersonic boundary layer over a large cone/flare configuration. Emphasis was on development and use of instrumentation with which to obtain flow-field measurements of the mean and fluctuating properties of the attached and separated shear layers. Development and use of holographic interferometry and electron-beam techniques in the high Mach number and Reynolds number environment developed in the shock tunnel are described. In the second study, detailed measurements of heat transfer, pressure, and skin friction were made on a unique 'blowing and roughness' model constructed to simulate the aerothermal phenomena associated with a rough ablating maneuverable reentry vehicle. In this study emphasis was placed on development and use of unique heat transfer and skin-friction instrumentation to obtain measurements of the combined effects of blowing and roughness and to understand how such effects influence boundary-layer separation in regions of shock wave/boundary layer interaction. Each focused around providing information with which to construct and evaluate the modeling required in time-averaged Navier-Stokes equations to predict the structure of compressible hypersonic boundary layers in regions of strong pressure gradient, shock-wave/boundary-layer interaction and flow separation over smooth, rough, and ablating surfaces.

31653 (BARC–1424) **Some studies on fluid structure interaction problems.** Singh, R.K.; Kakodkar, A.; Kant, T. Bhabha Atomic Research Centre, Bombay (India). 1988. 61p. Order Number DE89616963/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

In this report a review of fluid structure interaction problems has been made. The areas of development work on liquid container design, seismic response of pressure supression pool in a nuclear power plant, analysis of submerged structures and pulse induced vibration in coupled fluid shell systems are discussed. The areas of application for analysis of moderator filled calandria of a pressurised heavy water reactor (PHWR) and analysis of calandria tube/pressure tube/guide tube in case of overpressurisation of calandria are emphasised. A brief review of various methods for solving fluid structure interaction problem is then undertaken. A formulation for two dimensional and axi-symmetric problems based on finite element method using pressure field in fluid and displacement field in structure is presented along with a number of problems solved using this method. Implementation of implicit explicit mixed time integration scheme for solution of equations of the coupled field is discussed. A comparison has been made between present approach and structure mechanics priority approach. (author). 8 figs., 36 refs.

31654 (DP-MS–89-4) **Application of Lotus 1-2-3 to heat transfer analysis.** Bornt, F.W. Savannah River Lab., Aiken, SC (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. (CONF-890604–3-Vugraphs: Annual meeting of the American Nuclear Society, Atlanta, Georgia, USA, 4-8 Jun 1989). Order Number DE89010463/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

One often has to perform heat transfer analyses that are a bit involved for hand calculations, but are not quite large enough to justify the use of a special purpose heat transfer computer code. This paper describes the use of Lotus 1-2-3 for these "in between" problems. 5 refs., 2 figs.

31655 (INIS-BR–1509) **Transport coefficients for laminar and turbulent flow through a four-cusp channel.** Souza Dutra, A. de; Parise, J.A.R.; Souza Mendes, P.R. de. Associacao Brasileira de Ciencias Mecanicas, Rio de Janeiro, RJ (Brazil). 1986. 4p. (CONF-8612138–: 1. national meeting on thermal sciences, Rio de Janeiro, RJ, Brazil, 10-12 Dec 1986). Order Number DE89614215/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The heat transfer coefficients for laminar and turbulent flow in a four-cusp channel were determined. A numerical solution was developed for laminar flow an and experimental study for turbulent flow was carried out. Systematic variations of the Reynolds number were done in the range 900-30000. The results show that the heat transfer coefficients for the four-cusp channel are much lower than the coefficients for the circular tube.

31656 (PB–89-860225/XAB) **Water hammer in piping. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 110p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning explanations for the occurrence of water-hammer, analytical methods to predict the pressure surge rise, and prevention methods. Discussions center on specific piping components such as valves, pipes, tubes, pumps, elbows, fittings, surge tanks, and accumulators. Non-viscous, viscous, two-phase, and two-component fluids are examined. Applications include thermal, nuclear, and hydroelectric power plants, building service water systems, district-heating systems, municipal water mains, and general industrial piping systems. (Contains 264 citations fully indexed and including a title list.)

31657 (SAND–88-2741C) **Two-phase flow measurements by nuclear magnetic resonance imaging.** Givler, R.C.; Majors, P.D.; Altobelli, S.A.; Fukushima, E. Sandia National Labs., Albuquerque, NM (USA). 1989. 6p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906126–1: International conference on mechanics of two-phase flows, Taipei, Taiwan, 12-15 Jun 1989). Order Number DE89011850/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Nonuniform velocity and concentration profiles have been measured for suspensions of heavy particles flowing in horizontal tubes. All measurements were performed during steady flow conditions; mean particle concentrations were chosen between 1–10% and mean flow Reynolds numbers (based upon the fluid properties and the tube diameter) did not exceed 30. The time-averaged measurements were recorded noninvasively by using a flow-compensating, three- dimensional, pulse Fourier transform, nuclear magnetic resonance (NMR) technique. This method records both the fluid velocity and particle concentration information from a single experiment. Techniques have been implemented to resolve spatially the axial fluid velocity and particle concentration on a plane normal to the flow direction. This NMR scheme permits detailed analysis of the flow-induced structure of two-phase systems that will help to construct and verify the mathematical models used to predict multiphase flow behavior. 10 refs., 6 figs.

31658 Techniques for *in situ* determination of thermal resistance of lightweight board insulations. Courville, G. E. (Energy Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831-6092(US)); Beck, J. V. *Journal of Heat Transfer (USA),* 111(2): 274-280 (May 1989). DOE Contract AC05-84OR21400.

Four techniques for determining the *in situ* thermal resistance ofrigid board insulation installed in conventional low-sloped roofs aredescribed and compared. All techniques used measured temperature distributionsand heat fluxes in the roof systems. The limitations of the techniques arediscussed. Test results are presented to allow a comparison of the methods.

31659 Kelvin-Helmholtz instability and cooling limitations of a vertical molten sheet confined by alternating magnetic fields. Hull, J. R. (Argonne National Laboratory, Argonne, IL 60439 Mem. ASME(US)). *Journal of Heat Transfer (USA),* 111(2): 352-356 (May 1989). DOE Contract W-31-109-ENG-38.

Limitations imposed by a Kelvin-Helmholtz-type instability on the coolingof a vertical molten sheet that is confined by magnetic fields alternating intime are calculated. The molten sheet is cooled by a gas stream flowing on bothsides of the sheet. The Kelvin-Helmholtz instability imposes a maximum velocityon the cooling gas, which limits the cooling rate. The maximum cooling rate iscalculated with respect to the maximum velocity, gas physical properties, flowchannel geometry, surface tension, and magnetic field properties.

31660 Horizontal-tube falling-film evaporation with structured surfaces. Chyu, M. -C. (Assistant Professor, Department of Mechanical Engineering, Texas Tech University, Lubbock, TX 79409-4289 Assoc. Mem. ASME(US)); Bergles, A. E. *Journal of Heat Transfer (USA),* 111(2): 518-524 (May 1989).

Extensive experimental tests for tubes with commerical structured surfacesin a horizontal single-tube falling-film evaporator were conducted. The testsections were hollow copper cylinders with GEWA-T, Thermoexcel-E, or High Fluxsurfaces electrically heated by inserted cartridge heaters. A smooth surfacecylinder was also tested for reference. All tubes were tested in both poolboiling and falling-film evaporation with water. The results reveal thatfalling-film evaporation provides much higher heat transfer coefficients thanpool boiling in the low heat flux, convective region. The GEWA-T surfaceenhances heat transfer through its increased and accessible area, whileThermoexcel-E and High-Flux demonstrate high heat transfer performances becauseof enhanced nucleate boiling. The falling-film evaporation data for thestructured surfaces either merge or show a tendency to merge with the respectivepool boiling curves at high heat fluxes. Unusual incipient boiling behaviorof Thermoexcel-E and the effects of factors such as surface aging, surfacesubcooling, film flow rate liquid feed height, and rate of heat flux change,are described.

31661 Design and calibration of a local heat-flux measurement system for unsteady flows. Campbell, D. S. (Mchanical Engineering Department, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061(US)); Gundappa, M.; Diller, T. E. *Journal of Heat Transfer (USA),* 111(2): 552-557 (May 1989).

A local heat-flux measurement system was built, calibrated, and testedfor use in unsteady flows. The system was designed to maintainconstant-wall-temperature boundary conditions. The measuring element is athin-film heat flux gage made by sputter-coating gold onto a substrate.A constant-temperature anemometer is used to maintain the thin-film gage at aspecified temperature under fluctuating conditions. A separate temperaturecontrol system maintains the surrounding boundary at the gage temperature.The system was calibrated for both steady and unsteady flows using a speciallydesigned calibrator for local heat flux gages. The steady calibration was donewith predominantly convective heat transfer. The unsteady calibration wasachieved by adding oscillating radiant energy to the surface. Consequently,quantitative result can be obtained for both the mean and fluctuating componentsof the heat transfer. The frequency response was good to over 90 Hz.Sample results are presented of the unsteady heat transfer over a circularcylinder caused by natural vortex shedding at 70 to 80 Hz.

4205 Materials Testing

Refer also to citation(s) 31675

31662 (CONF-890277–1) **Measured damping and modulus of composite cylinders.** Andriulli, J.B. Oak Ridge National Lab., TN (USA). 1989. 64p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Damping '89; Palm Beach, Florida, USA; 8-10 Feb 1989. Order Number DE89010369/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Damping and moduli are measured on graphite and glass fiber/thermoset, thermoplastic, and metal matrix composite cylinders. Measurements are made by the impact-hammer modal-test method with the specimen suspended in the near free-free boundary condition. The axial and in-plane shear moduli are determined from the free-free axial and torsional vibration modes of the cylinder. Damping-loss factors for each of the associated modes are determined from the frequency-response function by the half-power point method or may also be determined by other curve-fitting methods. The effects on damping are presented for a number of different fiber/resin composites and for different layups of the same fiber/resin material. Cylinders are unique specimen configurations that permit simplified measurements of both the axial and in-plane shear (torsional) material properties from the same sample. The impact-hammer modal-test method provides a quick, inexpensive, small deformation, nondestructive estimate of the moduli and damping for the as-fabricated cylinders. After tests are completed, the cylinder can subsequently be used for its intended purpose. Details of the test method and procedure are described. 13 figs., 2 tabs.

31663 (FLT–303701) **Design and construction of automated freeze-thaw testing equipment for concrete. Final report.** Nawwar, A.M.; Roots, T.; Frere, D.; Nelson, R. Arctec Canada Ltd., Kanata, ON (Canada). 1988. 123p. (MICROLOG–89-01743). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Freeze-thaw cycles can be extremely destructive to concrete structures, such as those used in offshore platforms. Research on concretes for use in severe environments has created a need for systematic testing of samples exposed to such conditions. The project described in this report had the objective of studying the feasibility of designing and constructing an automated freeze-thaw testing machine. This machine would incorporate all aspects of freeze-thaw testing according to current standards. The functions of the new machine were divided into three main categories: temperature cycling, specimen property measurement, and system control. The requirements for accuracy, resolution, and control are outlined, and the design development process is summarized. Thermal analysis of the temperature cycle was performed to determine the heat loads on the heating and cooling systems, and the calculations are presented. A number of methods of measuring length changes were assessed, in order to achieve the requirement to detect a change in length of 0.1%. Two methods were evaluated for measuring the dynamic modulus of the concrete sample. The control system was designed to accept test parameters from the operator, determine the onset of sample failure, report test results, and control all aspects of machine operation; a personal computer was selected for the main control, data acquisition and processing tasks. Design and component selection criteria are provided for the heating and refrigeration system, measuring instruments, concrete specimen support and water circulation systems, computer hardware and software, and other related devices. Tests were carried out on the subassemblies of the machine and on the completed prototype. 32 figs., 11 tabs.

31664 (LBH–184-612) **Development of cementitious grouts for post-tensioned concrete members use in offshore structures and in the arctic environment. Vol. 3, Evaluation of pulse-echo technology for detection of voids in grouted ducts.** Seabrook, P.T.; Cumming, N.A. Levelton (B.H.) and Associates Ltd., Vancouver, BC (Canada). 1988. 123p. (MICROLOG–89-01720). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy,

Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A test specimen was designed to represent a typical icewall of a concrete offshore drilling structure. It contained seven tendon ducts which contained intentional voids of various sizes, locations and types. Three groups who have made recent advances in pulse-echo technology were invited to survey the specimen to attempt to identify and locate the voids, and the results from those tests are summarized in this report. Test methodologies are also described. Some conclusions are as follows. The National Bureau of Standards (NBS) impact-echo procedure was capable of identifying relatively small, deep voids in a heavily reinforced concrete wall; the NBS procedure holds the best potential for adaptation to field use. An ultrasonic technique developed by the US Army Corps of Engineers was able to identify a small, air-filled void at shallow depth, but resolution was relatively poor. A procedure developed by Techno Scientific (Woodbridge, Ontario) demonstrated limited success, but appears to require considerable refinement and calibration to become practical. The test specimen was found to contain relatively minor imperfections in the quality of grouting, consolidation of the concrete, and surface finish. The success of all three techniques appeared to deteriorate very rapidly when faced with such defects as entrapped air voids, incomplete encapsulation of the duct, and minor shrinkage of grout. Therefore, unless a very high quality of concreting and grouting are achieved in a real offshore structure, it may not be possible to obtain useful and meaningful results. 11 refs., 43 figs., 3 tabs.

31665 (SRC–8711) **Sixteenth progress report contract to develop an asbestos cement (A/C) cooling tower fill for thermal generating plants. Report no. 23.** Sherbrooke Research Centre, PQ (Canada). 1987. 114p. (MICROLOG–88-05003). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, , Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The author discusses the parameters influencing retention, flexural resistance prior to exposure to aggressive waters, resistance to visible deterioration and flexural resistance after exposure to aggressive waters followed or not by freezing and thawing or by moisture shock exposure, and resistance to visible deterioration and flexural resistance after exposure to freezing and thawing alone. The reduction in moduli caused by the various modes of accelerated weathering exposure was most influenced, for the products of both slags (Algoma Steel and Hamilton slags), by the following parameters, in decreasing order of importance: fibre length, fibre content, and superplasticizer content. The silica content of the fume and the mode of curing had an important influence only on the Algoma slag products. These products showed superior resistance to the Harkart test, which combines severe temperature and moisture shocks. The author discusses density and porosity before and after exposure to aggressive waters. The parameters that most influenced the reduction in porosity were the following, in decreasing order of importance: fibre length, pressing, and the type of aggressive water. 9 figs., 70 tabs.

31666 Atmospheric corrosion inhibition. Christensen, T.M. (Sandia National Labs., Albuquerque, NM (US)); Sorensen, N.R. v.v of Proceedings of the Electrochemical Society Fall meeting: Extended abstracts. Volume 87-2. The Electrochemical Society, Pennington, NJ (1987). (CONF-871027–: 172. meeting of the Electrochemical Society, Honolulu, Hawaii, USA, 18-23 Oct 1987).

Copper is commonly used in microelectronics applications where it may be susceptible to atmospheric corrosion. Atmospheric attack of the copper can lead to open circuits, short circuits, and an increase in processing time. The authors are studying the use of organic inhibitors (benzotriazole, BTA and tolytriazole, TTA) to limit oxidation/sulfidation during processing and to extend shelf life for partially assembled components. They are, therefore, interested in the effects of the inhibitors on copper joining process such as soldering and welding. Benzotriazole is used as a corrosion inhibitor for copper in aqueous and atmospheric environments. The authors have examined the effectiveness of BTA as a corrosion inhibitor in carefully controlled atmospheres and have investigated the nature of the BTA-Cu complex formed on the surface using X-ray Photoelectron Spectroscopy (XPS).

31667 A paraxial theory for the propagation of ultrasonic beams in anisotropic solids. Newberry, B. P. (Center for Nondestructive Evaluation, Iowa State University, Ames, Iowa 50011(US)); Thompson, R. B. *Journal of the Acoustical Society of America (USA)*, 85(6): 2290-2300 (Jun 1989).

The necessity of nondestructively inspecting cast steels, weldments,composites, and other inherently anisotropic materials has stimulatedconsiderable interest in wave propagation in anisotropic media. Here, theproblem of an ultrasonic beam traveling in an anisotropic medium is formulatedin terms of an angular spectrum of plane waves. Through the use of small angleapproximations, the integral representation is reduced to a summation ofGauss–Hermite eigensolutions. The anisotropic effects of beam skew and excess-beam divergence enter into the solution through parameters that are simplyinterpreted in terms of the slowness surface. Both time harmonic and pulsedsolutions are discussed. Formulas are also presented for transmission of a beamthrough a curved interface between two media. Examples are given illustratinghow this method may be applied to predicting beam patterns during ultrasonicinspections.

4208 Electronic Circuits and Devices

Refer also to citation(s) 31289, 31339, 31340, 31341, 31343, 31344, 31346, 31524, 31626, 31635, 31636, 31666, 31782, 31879, 31891, 31903, 32534, 32535

31668 (INIS-BR–1483, pp. 81) **Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/substrates.** Ferreira, S.O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Abramof, E.; Boschetti, C.; Bandeira, I.N. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (In Portuguese). (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BARIUM FLUORIDES/layers; BARIUM FLUORIDES/p-n junctions; BARIUM FLUORIDES/substrates; LEAD TELLURIDES/layers; LEAD TELLURIDES/p-n junctions; LEAD TELLURIDES/tin compounds; P-N JUNCTIONS/radiation detectors; TIN COMPOUNDS/layers; TIN COMPOUNDS/p-n junctions; LAYERS; SUBSTRATES; EFFICIENCY; USES

31669 (MU/CCORE–091) **Evaluation of two search radar systems for detection of ice masses.** Klein, K.; Ryan, J.P. Memorial Univ. of Newfoundland, St. John's (Canada). Centre for Cold Ocean Resources Engineering. 1988. V (MICROLOG–89-01228). Available from Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The desire to improve current airborne iceberg surveillance capability in support of offshore oil operations has raised interest in alternative radar systems. This study evaluated two generations of search radar, both made by Litton: the APS 504(V)5, a new state-of-the-art system, and the APS 504(V)3, already in use worldwide. Search radar was chosen as potentially suitable for iceberg surveillance since it was designed to operate at low altitudes and has the ability to scan the region of a target repetitively. Objectives were: to observe and document the radar's capability to detect icebergs under different conditions during normal surveillance operations; to develop a model specific to each radar system; and to collect signal data to investigate the radar properties of icebergs and the ocean. During the program it became evident that surveillance performance was a tradeoff between achieving an acceptable iceberg detection probability vs achieving an acceptable area of coverage per flight. The iceberg detection percentage did increase to a maximum as the distance to target was reduced to some minimum value, within which no further improvement was observed. The maximum achievable detection percentage, and the range at which it occurred, varied with iceberg size class and the environmental conditions. It was found that the capabilities of the (V)5 model exceeded those of the (V)3; the (V)5 demonstrated a reasonably high percentage detection of small icebergs (80-90%) and a moderate capability to

detect bergy bits (50-70%). Under calm seas, at 1500 ft and using the radar's longer pulse width, flight line spacing can be 38 nautical miles while retaining a high detection percentage for small icebergs. Includes glossary. 13 refs., 86 figs., 47 tabs.

31670 (NEI-DK–162) **Nickel - iron battery.** Petersen, H.A. Energilaboratoriet, Odense (Denmark). Mar 1989. 34p. (In Danish). Order Number DE89766863/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

EFP-87.

A newer type of nickel-iron battery, (SAFT 6v 230 Ah monobloc), which could possibly be used in relation to electrically driven light road vehicles, was tested. The same test methods used for lead batteries were utilized and results compared favourably with those reached during other testings carried out, abroad, on a SAFT nickle-iron battery and a SAB-NIFE nickel-iron battery. Description (in English) of the latter-named tests are included in the publication as is also a presentation of the SAFT battery. Testing showed that this type of battery did not last as long as had been expected, but the density of energy and effect was superior to lead batteries. However energy efficiency was rather poor in comparison to lead batteries and it was concluded that nickel-iron batteries are not suitable for stationary systems where recharging under a constant voltage is necessary. (AB).

31671 (OH/RD–419G485) **Development of a prototype robotic system for the in-situ repair of hydraulic turbine runners.** Tinkler, M.J.; Fihey, J.L. Ontario Hydro Research Div., Toronto, ON (Canada). 1989. 83p. (CE–02619). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The first phase of a project to develop a compact robotic system for the in situ repair of cavitation damage in hydraulic turbine runners is described. A rational conceptual solution to the problem has been developed and two prototype track-based robotic systems have been assembled, capable of performing air-arc gouging, welding and grinding as required. The system's capabilities have been demonstrated in the laboratory on a two-blade Francis runner mockup. Subsequent work will address certain system shortcomings, so that field trials with the laboratory prototype can be undertaken. 7 refs., 76 figs.

31672 (SAND–88-3356C) **Photoconductive semiconductor switch (PCSS) recovery.** Zutavern, F.J.; Loubriel, G.M.; McKenzie, B.B.; O'Malley, W.M.; Hamil, R.A.; Schanwald, L.P.; Hijalmarson, H.P. Sandia National Labs., Albuquerque, NM (USA). 1989. 24p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–2: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89012657/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Attempts to use photoconductive semiconductors as high-power (10-100 kV, 0.1-2 kA) toggling switches with recovery times of 5-100 ns have stimulated the exploration of their recovery mechanisms. We have observed that optically triggered GaAs switches exhibit "lock-on," i.e., when triggered, they do not recover as long as they are holding more than 4-8 kV/cm. Experiments are being performed to determine the minimum recovery time of these switches after lock-on, by immediately reducing fields or currents. As an alternative to GaAs, Si is a semiconductor that does not exhibit lock-on. It has a very long recovery time ($\geq$100 μs) that can be shortened to less than 100 ns with highly concentrated gold doping ($\geq 10^{15}/cm^3$). Device models that predict behavior of PCSS and experiments on the recovery of GaAs and Au:Si switches are presented. 12 refs., 13 fig.

31673 (SAND–88-3399C) **Closing photoconductive semiconductor switches.** Loubriel, G.M.; Zutavern, F.J.; Hjalmarson, H.P.; O'Malley, M.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–10: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013073/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

One of the most important limitations of Photoconductive Semiconductor Switches (PCSS) for pulsed power applications is the high laser powers required to activate the switches. In this paper, we discuss recent developments on two different aspects of GaAs PCSS that result in reductions in laser power by a factor of nearly 1000. The advantages of using GaAs over Si are many. First of all, the resistivity of GaAs can be orders of magnitude higher than that of the highest resistivity Si material, thus allowing GaAs switches to withstand dc voltages without thermal runaway. Secondly, GaAs has a higher carrier mobility than Si and, thus, is more efficient (per carrier). Finally, GaAs switches can have naturally fast (ns) opening times at room temperature and low fields, microsecond opening times at liquid nitrogen temperature of 77 K, or, on demand, closing and opening at high fields and room temperature by a mechanism called lock-on (see Ref. 1). By contrast, Si switches typically opening times of milliseconds. The amount of laser light required to trigger GaAs for lock-on, or at 77 K, is about three orders of magnitude lower than at room temperature. In this paper we describe the study of lock-on in GaAs and InP, as well as switching of GaAs at 77 K. We shall show that when GaAs is switched at 77 K, the carrier lifetime is about three orders of magnitude longer than it is at room temperature. We shall explain the change in lifetime in terms of the change in electron capture cross section of the deep levels in GaAs (these are defect or impurity levels in the band gap). In the second section, we describe the lock-on effect, now seen in GaAs and InP, and at fields as high as 70 kV/cm. We show how lock-on can be tailored by changing the GaAs temperature or by neutron bombardment. In the third section, we discuss possible lock-on mechanisms. 5 refs., 5 figs.

31674 (SAND–89-0020C) **An SCR-switched, high voltage, high gain linear transformer system.** Rohwein, G.J.; Lawson, R.N. Sandia National Labs., Albuquerque, NM (USA). 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–6: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013072/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A 100-J, 100-KV linear transformer system has been designed to demonstrate the general characteristics of solid-state switched. multi-stage transformers that could be adapted to applications including high-pulse repetition rates and high duty cycles without requiring auxiliary equipment such as that associated with spark gaps or thyratrons. The transformer has four 1200-V parallel, separately switched, primary sections and a net voltage gain of 100. It can be operated in either an air core or partial magnetic core configuration. Testing included normal and fault mode operation with both resistor and capacitor loads. The system delivered full voltage output with all primary drives in the circuit and only proportionally lower output with one to three drives disconnected. This demonstrated that linear transformer sections utilizing many primary stages could be expected to continue functioning properly with relatively small decrease in output if a component failure occurred in one or two sections during operation, and faulty section(s) were fused or switched out of the circuit. This feature could be important in applications requiring very high reliability. 3 refs., 13 figs.

31675 (SAND–89-0486C) **Resistive Contrast Imaging applied to multilevel interconnection failure analysis.** Cole, E.I. Jr. Sandia National Labs., Albuquerque, NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906115–1: VLSI multilevel interconnection conference, Santa Clara, California, USA, 12-14 Jun 1989). Order Number DE89011066/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Resistive Contrast Imaging (RCI) is a new failure analysis technique that uses a scanning electron microscope to generate a relative resistance map of an integrated circuit. The RCI map may be used to localize abrupt changes in resistance and verify continuity. Results using RCI on several two-level interconnection devices are described. The images demonstrate how RCI may be used to differentiate between levels and to localize metal shorts and opens. Methods for improving image quality and level differentiation as well as future development work are discussed. 9 refs., 8 figs.

31676 (SAND–89-1085C) **Evaluation of waveform digitizer systems and components in accordance with IEEE waveform digitizer standards.** Green, P.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 46p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890694–3: Instrumentation for nuclear weapons effects testing conference, Monterey, California, USA, 5-8 Jun 1989). Order Number DE89010861/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Our division is charged with instrumentation development in support of underground testing. We find it necessary to be able to evaluate the performance of waveform digitizing systems with sampling rates from a few kilohertz to more than a gigahertz. We have been developing an integrated system which can provide quantitative results on the performance of systems and subsystems. Here we describe a system which is controlled by a Microvax II with instrumentation control through the IEEE-488 buss. The evaluation procedures are aimed at being consistent with a new Trial Waveform Digitizer Standard generated by the Waveform Measurements and Analysis committee appointed by the Instrumentation and Measurement Society of IEEE. This standard has been recently accepted by the IEEE and will be published in the next few months. Attention is given to the accurate measurement of effective-bit performance and differential nonlinearity of waveform digitizers. 3 refs., 14 figs.

31677 (UCRL–53925) **Lightning: Understanding it and protecting systems from its effects.** Hasbrouck, R.T. Lawrence Livermore National Lab., CA (USA). 10 Apr 1989. 41p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-890589–2: 35. international instrumentation symposium, Orlando, Florida, USA, 30 May - 30 jun 1989). Order Number DE89012796/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This tutorial will raise the reader's level of lightning consciousness by providing an overview of the atmospheric electrification process and by discussing the development and characteristics of a lightning discharge. Next, techniques and instrumentation for lightning threat warning, detection and tracking will be presented. Finally, the principles of protection will be discussed, along with several methods for testing that protection. 15 refs., 16 figs.

31678 (UCRL–100861) **A hybrid 3 Gs/s, 6-bit digital to analog converter.** Priatko, G.J.; Thompson, B.L.; Kaskey, J.A. Lawrence Livermore National Lab., CA (USA). 6 Apr 1989. 17p. Sponsored by DOE Nuclear Energy. DOE Contract W-7405-ENG-48. (CONF-8906127–1: UGIM symposium, West Borough, Massachusetts, USA, 12-14 Jun 1989). Order Number DE89012302/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A hybrid GaAs 3 Gigasample per second (Gs/s) digital to analog converter (DAC) is presented. Five-hit 1-Gs/s operation and peak operating speeds of 3 Gs/s are demonstrated. DC differential and integral linearity are shown to be consistent with 6-bit operation. Sub-500-ps settling times are demonstrated at operating speeds of 1–3 Gs/s. The device has ECL level differential inputs and is capable of producing a 1-V output when driven into 50 Ω. The hybrid DAC is implemented with thin film resistors and commercially available GaAs MESFETs. Power dissipation is approximately 1.5 W. 7 refs., 9 figs.

31679 Window cleaning and fluorine incorporation by XeF_2 in photochemical vapor deposition. Langford, A. A. (Solar Energy Research Institute, Golden, Colorado 80401(US)); Bender, J.; Fleet, M. L.; Stafford, B. L. *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena (USA),* 7(3): 437-442 (May 1989). DOE Contract AC02-83CH10093.

A new method of maintaining window transparency in photochemical vapor deposition (photo-CVD) has been developed in which the window is continuously etched clean during the deposition process. This technique is demonstrated in the deposition of *a*-Si:H(F) by direct photo-CVD of Si_2H_6 using XeF_2 as an etchant. XeF_2 is also used to clean the chamber between runs. Fluorine may be incorporated in the films via either gas phase or surface reactions with XeF_2. The optoelectronic quality of *a*-Si:H:F decreases with F incorporation, which suggests that this technique may be particularly suited to the deposition of μc-Si:H(F) and *a*-SiGe :H(F) and *a*-SiC :H(F) alloys wherein fluorinated process gases are preferentially employed.

4209 Waste Processing Plants and Equipment

Refer also to citation(s) 30918

4210 Combustion Systems

Refer also to citation(s) 30323, 31580, 31583

31680 (CANMET–88-60) **Low NO/sub x//SO/sub x/burner trials. CFB Gagetown.** Lee, G.K.; Philip, R.J. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1988. V (MICROLOG–89-01956). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The effectiveness of a staged burner concept with limestone injection to control nitrogen (NO/sub x/) and sulphur oxides (SO/sub 2/and SO/sub 3/) emissions from a pulverized coal fired generator at Canadian Forces Base Gagetown has been successfully demonstrated. The retrofit installation was capable of achieving up to 50% reduction in NO/sub x/and SO/sub 2/emissions from the combustion of eastern Canadian coals containing 3% sulphur and 10% ash, with an improvement in generator efficiency. The limestone injection multi-staged burner installation was safely and reliably operated during the 1987-88 heating season, following a number of design modifications to the coal burner and limestone metering systems. Its overall performance will be monitored during the next two heating seasons to evaluate its long-term availability. 22 figs., 11 tabs.

31681 (CANMET–5078-01) **Combustion enhancement by induced Rayleigh instability.** McElroy, R.; Jezko, J. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1988. 41p. (MICROLOG–89-01723). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents a review of the literature on atomization by induced Rayleigh instability and reports the results of attempts to modify a commercial oil furnace burner to improve combustion by electrical charging of fuel droplets. However, test results and observations indicate that all attempts to charge oil droplets to the threshold of Rayleigh instability in the furnace burner were unsuccessful. Modifications of the furnace system were made in order to allow for continuous operation of the furnace and to electrically insulate the atomizing nozzle for electrostatic charge imposition. With these modifications, a potential of 7 kV could be applied to the nozzle without electrical arc discharge, at least in the initial periods of operation. After the deposition of soot on the burner parts, the potential that could be sustained without discharge dropped to below 1 kV. At the conditions of no arc discharge, the measured current in the system was 3 μA. The calculation of the charge carried by one droplet yielded a value two orders of magnitude lower than necessary for the Rayleigh instability to occur. Comparison of measured combustion characteristics with and without applied electrostatic charge showed the effect of the charge to be insignificant. The literature review indicates that research on induced Rayleigh instability has been largely focussed on the development of spraying systems without regard to the finer droplet sizes required for atomization. 27 refs., 5 figs., 2 tabs.

31682 (OME–1988) **Field testing and monitoring of two high efficiency condensing gas boilers installed in a highrise building.** Zaidi, A.; Rhodes, C.; Scicluna, E.; Rygier, D. Ontario Ministry of Energy, Toronto, ON (Canada). [1989]. 46p. (MICROLOG–89-00398). Available from Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report presents the design, installation, operation, and thermal performance results of two ADMIC-built high efficiency condensing gas boilers. The boiler design was a further refinement to the condensing boiler developed by the Canadian Gas Research Institute. The boilers were retrofitted to an existing hydronic heating plant located in the basement boiler room of a high-rise apartment building in Metro Toronto. Key innovative features of the ADMIC boiler include: reduced physical size, high operating pressure (1400 nilopascals), low exhaust temperatures (allowing use of plastic vent pipes), and no restriction on boiler location or stack installation due to power venting. The monitoring results show that the ADMIC high efficiency boilers were operating at a seasonal thermal efficiency of 86% whereas the two conventional boilers were operating at efficiencies of 68 and 64%. The total energy savings at this site are estimated at 4032 GJ per annum by comparing the ADMIC boilers' efficiency with the conventional boilers' efficiencies; this translates into cost savings of $19,112 per annum and a payback period of 2.25 years. The application of these condensing boilers for direct domestic hot water heating should be further investigated, since these boilers produce efficiencies in excess of 90% at low inlet water temperatures. 5 figs., 8 tabs.

31683 Thermal measurements in large pool fires. Gregory, J. J. (Thermal Test and Analysis Division, Sandia National Laboratories Albuquerque, NM 87185(US)); Keltner, N. R.; Mata, R., Jr. *Journal of Heat Transfer (USA),* 111(2): 446-454 (May 1989). DOE Contract AC04-76DP00789.

During the summer of 1983, a series of pool fire tests was conducted inwhich the test item was a 1.4-m-dia, 6.4-m-long, mild steel calorimeter with amass of approximately 10,000 kg. The purpose of these tests was to study thethermal response of a large test item in a specified fire configuration, todefine thermal boundary conditions, and to assess the repeatability of the fireenvironment. While the calorimeter used in the tests simulated a nuclear wastetransportation cask, the results of the study have broader application to thetruck and rail transport of hydrocarbon fuels and hazardous chemicals.

31684 Acoustic temperature profile measurement technique for large combustion chambers. Venkateshan, S. P. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109(US)); Shakkottai, P.; Kwack, E. Y.; Back, L. H. *Journal of Heat Transfer (USA),* 111(2): 461-466 (May 1989).

Measurement of times of flight of sound waves can be used to determinetemperatures in a gas. This paper describes a system, based on this principle,that is capable of giving the temperature profile in a nonisothermal gasvolume, for example, prevalent in a large furnace. The apparatus is simple,rugged, accurate, and capable of being automated for process controlapplications. It is basically an acoustic waveguide where the outsidetemperature profile is tranferred to a chosen gas contained inside theguide.

4220 Underground Engineering

31685 (CMRC–82/64-BG) **Procedural guide for roof bolt anchorage tests.** Thornton, S.E. Coal Mining Research Centre, Edmonton, AB (Canada). 1982. 5p. (CE–02436). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages.

Two testing methodologies are presented to determine the support being provided by rock bolts. These tests are the torque test, and the rock bolt pull test or tension test. They are used to determine the value of the maximum anchorage of a given rock bolt. From these results it is then possible to correct the design or the procedure being used. The torque test can be used in two ways: to determine if a rock bolt is torqued to the design value, and to estimate the value of the maximum anchorage of a bolt. The rock bolt pull test or tension test is a direct method of determining the maximum anchorage value of a rock bolt. The equipment and the method of operating the equipment are outlined. 7 refs.

4230 Marine Engineering

Refer also to citation(s) 31664, 31669

31686 (AUC-IBT-R–8806) **Probabilistic design of offshore structural systems.** Structural Reliability Theory. Paper, 42. Soerensen, J.D. Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik. Feb 1988. 5p. (CONF-8805290–: ASCE probabilistic methods conference, Blacksburg, Virginia, USA, 25-27 May 1988). Order Number DE89776139/JAW. Available from NTIS (US Sales Only), PC A02/MF A01;1.

Structural Reliability Theory. Paper, 42.

Probabilistic design of structural systems is considered in this paper. The reliability is estimated using first-order reliability methods (FORM). The design problem is formulated as the optimization problem to minimize a given cost function such that the reliability of the single elements satisfies given requirements or such that the sytems reliability satisfies a given requirement. Based on a sensitivity analysis optimization procedures to solve the optimization problems are presented. Two of these procedures solve the system reliability-based optimization problem sequentially using quasi-analytical derivatives. Finally an example of probabilistic design of an offshore structure is considered.

31687 (MU/CCORE–88-12) **Feasibility study of full scale iceberg impact tests.** Memorial Univ. of Newfoundland, St. John's (Canada). Centre for Cold Ocean Resources Engineering. 1988. 140p. (MICROLOG–89-01822). Available from Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report establishes that full-scale large iceberg impact experiments are feasible. Such experiments would be an advance in ice mechanics and in the prediction of iceberg impact forces on offshore structures. Potential sites complying to specified criteria for a test site have been identified along the coast of Newfoundland and Labrador. The recommended location is Deep Water Point, near St. Anthony, on the northern tip of Newfoundland. This location meets the required criteria having a relatively predictable iceberg population, steep cliffs, deep water alongshore and is in close proximity to a roadway and a local settlement. Hydraulic model tests were used to determine the most practical and efficient method of conducting experiments, while ensuring iceberg impact on the target area. Various towing/winching configurations were tested while simulating alongshore ocean currents. The recommended experimental method is to tow an iceberg into the cliff with two tugboats. Model tests confirm that this method provides the best control, stability and reliability to impact the iceberg on target. The report also discusses the phenomena that should be monitored and instrumentation requirements. The predicted cost of such a project is broken down into various project phases, and rough cost estimations have been made. 50 figs., 10 tabs.

31688 (NEI-NO–63) **Programme for marine structures. Summary report.** Norges Teknisk-Naturvitenskapelige Forskningsraad, Oslo (Norway). Feb 1986. 208p. Order Number DE89766884/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

The programme was a three year research program, planned at the end of 1982 and finalized at the end of 1985. The overall goal of the program has been to contribute to development within the relevant hydrodynamical and structured problem areas for deepwater platforms. A total number of 6 projects have been defined within the program: Viscous problems; large motions and loads; wind, wave, current effects; dynamic response; fatigue; collapse behaviour, and response strength. Aims for each project are briefly stated in the short section of the report in front of the summary for each project. 82 refs., 65 figs.

31689 (RF/PRC/T–7/86) **Position controllable working platform in derricks.** Risa, R.; Gard, J.R. Rogalandsforskning, Stavanger (Norway). Mar 1986. 66p. (In Norwegian). Order Number DE89766876/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Appendix on maintenance and work routines.

The report discusses work simplification on offshore drilling platforms, and focuses on the need for a position controllable work platform in derricks. The various labour-related operations in the derrick are mapped both regarding execution and timing. A well-designed work platform seems to be more efficient and safe

compared to the general riding belt used in the various operations. 14 figs.

31690 (STF–85037) **New method for the cleaning of drilling mud.** Kvitvang, A.; Gjersvik, T.B. Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway). Mar 1985. 49p. (In Norwegian). Order Number DE89766878/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The report deals with the test results from a bench-scale experiment on the cleaning of both water- and petroleum based drilling mud. The continous operating device designed for the cleaning operation is presented. The methods used for the evaluation of the test results showed only marginal cleaning effects. 12 figs., 13 tabs., 17 refs.

4240 Pollution Control Equipment

Refer also to citation(s) 31690, 31913

43 PARTICLE ACCELERATORS

4301 Design, Development, and Operation

Refer also to citation(s) 31648, 31842, 32542, 32770, 32925, 32930

31691 (ANU-P–992) **Corona gradient distribution system variations and homogenization.** Weisser, D.C. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Aug 1987. 10p. Order Number DE89616996/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The corona current at 5 KV in air was measured for all tube point assemblies in the 14UD at Canberra. Variation in current of plus and minus a factor of three to four where found which imply voltage variations for fixed current of plus and minus 0.6 to 0.8 of the average voltage. Variations were worst at the tube ends, the sites of the major electron suppression fields. All extreme assemblies were regapped to homogenize the gradient. The consistency of the gradient over several months was also monitored and found to be within the intrinsic distribution.

31692 (CONF-890335–170) **An improved phase-control system for superconducting low-velocity accelerating structures.** Bogaty, J.M.; Clifft, B.E.; Shepard, K.W.; Zinkann, G.P. Argonne National Lab., IL (USA). 1989. 3p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, Illinois, USA; 20-23 Mar 1989. Order Number DE89013305/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Microphonic fluctuations in the rf eigenfrequency of superconducting (SC) slow-wave structures must be compensated by a fast-tuning system in order to control the rf phase. The tuning system must handle a reactive power proportional to the product of the tuning range and the rf energy content of the resonant cavity. The accelerating field level of many of the SC cavities forming the ATLAS linac has been limited by the rf power capacity of the presently used PIN-diode based fast-tuner. A new system has been developed, utilizing PIN diodes operating immersed in liquid nitrogen, with the diodes controlled by a high-voltage VMOS FET driver. The system has operated at reactive power levels above 20 KVA, a factor of four increase over an earlier design. 7 refs., 2 figs.

31693 (CONF-890335–172) **Heavy-ion superconducting linacs.** Delayen, J.R. Argonne National Lab., IL (USA). 1989. 5p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, Illinois, USA; 20-23 Mar 1989. Order Number DE89013303/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper reviews the status of the superconducting heavy-ion accelerators. Most of them are linacs used as boosters for tandem electrostatic accelerators, although the technology is being extended to very low velocity to eliminate the need for an injector. The characteristics and features of the various superconducting heavy-ion accelerators are discussed. 45 refs.

31694 (CONF-8810182–30) **The Aspun Project.** Kustom, R.L. Argonne National Lab., IL (USA). 1988. 14p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From International collaboration on advanced neutron sources (ICANS); Los Alamos, New Mexico, USA; 3-7 Oct 1988. Order Number DE89013184/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A study of pulsed spallation neutron source, that could deliver fluxes in excess of 1×10^{17} N/cm^2-sec began at Argonne in 1981. A review of various accelerator concepts to act as an intense charged particle source to generate spallation neutrons resulted in the selection of a Fixed-Field Alternating-Gradient (FFAG) accelerator as the preferred devices. This paper describes the design and operation of the FFAG Accelerator. 10 refs., 6 figs.

31695 (GSI–89-31(prepr.)) **Status of the SIS/ESR-project at GSI.** Kienle, P. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Mar 1989. 14p. (CONF-8902107–: School on nuclear matter and heavy ion collisions, Les Houches, France, 7-16 Feb 1989). Order Number DE89774714/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

This is a report on the status of the construction of the SIS/ESR-accelerator complex and the experimental equipment at GSI as of February 1989.

31696 (LA-UR–89-1599) **Use of the delta-t method for setting rf phase and amplitude for the AHF linac.** Swain, G.R. Los Alamos National Lab., NM (USA). 1989. 17p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890299–8: AHF accelerator design workshop, Los Alamos, New Mexico, USA, 20-25 Feb 1989). Order Number DE89012619/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The delta-t procedure is a time-of-flight method of finding set points for the rf phase and amplitude for each module of a linac. Expected errors for LAMPF afterburner linacs which might be used for an advanced hadron facility (AHF) are calculated. The modified delta-t procedure used on modules 13 through 48 of the present linac appears adequate to set up the proposed AHF linacs. 24 refs., 7 figs., 1 tab.

31697 (LBL–27059) **Elements of a realistic 17 GHz FEL/TBA design.** Hopkins, D.B.; Halbach, K.; Hoyer, E.H.; Sessler, A.M.; Sternbach, E.J. Lawrence Berkeley Lab., CA (USA). Jan 1989. 11p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890197–9: Advanced accelerator concepts workshop, Lake Arrowhead, California, USA, 9-13 Jan 1989). Order Number DE89013427/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Recently, renewed interest in an FEL version of a two-beam accelerator (TBA) has prompted a study of practical system and structure designs for achieving the specified physics goals. This paper presents elements of a realistic design for an FEL/TBA suitable for a 1 TeV, 17 GHz linear collider. 13 refs., 8 figs., 2 tabs.

31698 (OEVS-Mitteilung–1988, pp. 404-408) **Radiation protection requirements on exhaust air installations of low-energy particle accelerators.** Knieper, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie); Sauermann, P.F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

During operation of accelerators the air of irradiation rooms, gets activated by neutrons. The radioactive gases and aerosols contribute to the radiation exposure of persons in the neighbourhood. Recommendations are given how emissions and therefore the radiation burden can be minimized. The recommendations are applied to the exhaust air installations of a compact-cyclotron and a mini-cyclotron. 8 figs.

31699 (OEVS-Mitteilung–1988, pp. 409-413) **Shielding of high energy heavy ion accelerators.** Weise, H.P. (Bundesanstalt fuer

Materialpruefung, Berlin (Germany, F.R.)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook*. Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Simple relationships have been derived which allow the calculation of radiation shields against high energy neutrons produced by relativistic heavy ions. Neutron yields for heavy ion beams in the energy range from 0,4 to 2 GeV/nucleon were estimated using measured differential neutron and proton production cross sections. Effective neutron dose transmission factors for ordinary concrete (or soil) were calculated from shielding data for monoenergetic neutrons by folding with the neutron spectra. The same method was used for proton beams and compared with existing shielding data. 10 refs., 8 figs.

31700 (OEVS-Mitteilung–1988, pp. 424-428) **Shielding of low-energy cyclotrons.** Sauermann, P.F. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie); Knieper, J.; Komnick, K.; Printz, H. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook*. Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Equivalent neutron- and gamma dose rate measurements as a function of wall thickness were done for ordinary concrete and limonite concrete, with different particles and varying energies. Basing on these data shieldings of low-energy cyclotrons can be calculated easily. 6 refs., 2 tabs.

31701 (SAND–89-0069C) **Performance of the Hermes-III pulse forming lines.** Alexander, J.A.; Corley, J.P.; Johnson, D.L.; Denison, G.J.; Hodge, K.; Pankuch, P.; Ramirez, J.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–9: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013075/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Hermes III is a new 20-MV, 730-kA, 40-ns pulsed power accelerator. In Hermes III, eighty pulse forming lines (PFLs) generate 1.1-MV, 220-kA pulses, which are then added in a series/parallel configuration to produce the desired output pulse. Under normal Hermes-III operation, the PFLs produce a ~40-ns FWHM pulse with a ~15-ns, 10-90% rise time, and a one-sigma jitter of ~4 ns. The Hermes-III water-dielectric PFLs have undergone 18 months of testing. During this period, over 59,000 PFL-shots have been accumulated, most of these at or near peak power. The PFLs have met design specifications, and they have proven to be highly reliable. This paper presents a brief overview of the PFL design, together with a detailed discussion of the system performance and limitations during the extensive testing period. A modification to the PFLs to produce a ramped output pulse was designed and tested. Results indicate that a ramped output pulse can be produced using a stepped impedance PFL. 8 refs., 12 figs.

31702 (SLAC–341) **Annual environmental monitoring report, January–December 1988.** Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 38p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE89013316/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses the environmental impact from gaseous and liquid effluents released by the accelerator facility at Stanford Linear Accelerator Center. 9 refs., 5 figs., 7 tabs. (LSP)

31703 (SLAC-PUB–4849) **Accelerator diagnosis and control by Neural Nets.** Spencer, J.E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Jan 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–165: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012789/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Neural Nets (NN) have been described as a solution looking for a problem. In the last conference, Artificial Intelligence (AI) was considered in the accelerator context. While good for local surveillance and control, its use for large complex systems (LCS) was much more restricted. By contrast, NN provide a good metaphor for LCS. It can be argued that they are logically equivalent to multi-loop feedback/forward control of faulty systems, and therefore provide an ideal adaptive control system. Thus, where AI may be good for maintaining a 'golden orbit,' NN should be good for obtaining it via a quantitative approach to 'look and adjust' methods like operator tweaking which use pattern recognition to deal with hardware and software limitations, inaccuracies or errors as well as imprecise knowledge or understanding of effects like annealing and hysteresis. Further, insights from NN allow one to define feasibility conditions for LCS in terms of design constraints and tolerances. Hardware and software implications are discussed and several LCS of current interest are compared and contrasted. 15 refs., 5 figs.

31704 (SLAC-PUB–4851) **The Stanford Linear Collider, fall 1988.** Burke, D.L. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 35p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8808145–33: Meeting of the Division of Particles and Fields of the American Physical Society (APS), Storrs, Connecticut, USA, 15-18 Aug 1988). Order Number DE89012787/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper contains a description of the Stanford Linear Collider and a summary of its performance during recent periods of operation. 20 refs., 34 figs., 1 tab.

31705 (SLAC-PUB–4894) **A new switched power linac structure.** Villa, F. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 11p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8803129–4: 4. workshop on laser switched power accelerators, Erice, Italy, 4-9 Mar 1988). Order Number DE89011282/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A new pulse power structure has been described that utilizes an easily accessible rectilinear switch. The new structure is more "forgiving" (as far as risetime is concerned) than the radial line transformer, and contains fewer switching structures/unit length. The combination of the new structure with the switch proposed seems to offer interesting possibilities for a future linear collider. 13 refs., 6 figs., 2 tabs.

31706 (SLAC-PUB–4975) **Report on the international workshop on next generation linear colliders.** Ruth, R.D. Stanford Linear Accelerator Center, Menlo Park, CA (USA). May 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–152: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012263/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Many laboratories around the world have begun vigorous research programs on a next generation linear collider (NLC). However, it has been recognized that the research towards NLC is beyond the capabilities of any one laboratory presently. This workshop was organized to begin a series of workshops that address this problem. Specifically, the main goals of the workshop were to discuss research programs of the various laboratories around the world, to identify common areas of interest in the various NLC designs, and finally to advance these programs by collaboration. The particular topics discussed briefly in this paper are: parameters, rf power, structures, final focus, beam dynamics, damping rings, and instrumentation. 2 refs., 3 figs., 6 tabs.

31707 (UCRL–99869) **High average-power induction linacs.** Prono, D.S.; Barrett, D.; Bowles, E.; Caporaso, G.J.; Chen, Yu-Jiuan; Clark, J.C.; Coffield, F.; Newton, M.A.; Nexsen, W.; Ravenscroft, D. Lawrence Livermore National Lab., CA (USA). 15 Mar 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890335–185: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number

DE89012968/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Induction linear accelerators (LIAs) are inherently capable of accelerating several thousand amperes of ~ 50-ns duration pulses to > 100 MeV. In this paper we report progress and status in the areas of duty factor and stray power management. These technologies are vital if LIAs are to attain high average power operation. 13 figs.

31708 A high intensity hadron facility, AGS II. Lee, Y. Y. (AGS Department, Brookhaven National Laboratory, Associated Universities, Inc., Upton, New York 11973(US)); Lowenstein, D. I. *AIP (American Institute of Physics) Conference Proceedings (USA)*, 185(1): 185-192 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

We present a proposal for an upgrade of the Brookhaven AGS which would fulfill a growing demand for a hadron facility with proton beam energies 12 – 60 GeV and intensities 30 – 100 μA. The BNL approach to the nuclear and particle physics communities interests involves a step wise intensity upgrade program. At present the AGS slow extracted beam current is 1 μA. With the completion of the Booster in 1990 and the associated AGS modifications, the current will rise to 4–5 μA. With subsequent adition of the Stretcher which is under design, the current will rise to 8–10 μA and approximately 100% duty factor. We are now examining the possibility of a further enhancement to a current level of 40–50 μA CW. (AIP)

31709 Review of RHIC as a B factory. Morse, W. M. (Brookhaven National Laboratory, Upton, NY 11973(US)). *AIP (American Institute of Physics) Conference Proceedings (USA)*, 185(1): 661-669 (25 Apr 1989). DOE Contract AC02-76CH00016. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

I discuss a dedicated B physics experiment wihich was considered at the 1988RHIC Summer Workshop. The machine may operate in a *p-p* mode with aluminosity in excess of 10^{32} cm^{-2} sec^{-1} at 250–250 GeV. Themost ambitious physics objective of such an experiment would be the study ofCP nonconservation. Particular emphasis at the workshop was given to the selftagging mode $B \rightarrow K^{+}\pi-$. Experimental techniques developed during this experiment would be extremely useful for more ambitious projects anticipated at the SSC.

31710 Photon accelerator. Wilks, S. C. (Department of Physics, University of California, Los Angeles, California 90024 and Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Dawson, J. M.; Mori, W. B.; Katsouleas, T.; Jones, M. E. *Physical Review Letters (USA)*, 62(22): 2600-2603 (29 May 1989). DOE Contract FG03-87ER13752.

A novel method of frequency upshifting short ($\leq$1 ps) pulses of laser light, which makes use of relativistic plasma waves, is described. This method makes use of the fact that a laser pulse moving in a plasma can be thought of as a packet of photons, each possessing an effective mass of $m_{\gamma}=\hbar\omega_{pe}/c^2$ and moving with the group velocity of the laser pulse. These photons experience a force acting on them when in the presence of a gradient in the plasma density. By using a relativistic plasma wave (i.e., a moving density gradient) traveling with the photons, energy of the photons (thus the frequency) can be continuously increased.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 31648, 31752, 31760, 31777, 31778, 31792, 31793, 31794, 32864

31711 (AD-A–204285/1/XAB) **Assessment of a novel r-f linac amplifier concept. Final report, June 1987-July 1988.** Mani, S.A.; Kahan, L.; Dudkin, A. Science Applications International Corp., Lexington, MA (USA). 20 Sep 1988. 55p. Available from NTIS, PC A04/MF A01.

This report discusses a potential method of increasing the peak current of an r-f linear accelerator without significantly degrading the transverse emittance of the beam. This can be achieved at the expense of increasing the longitudinal phase space of the beam; if this increase in longitudinal phase space is acceptable, the Free Electron Laser performance does not degrade much. First, the authors describe their concept for increasing the micropulse peak current. Then they estimate the change in brightness of the beam using first order transport properties of the beam. They also analyzed the performance of the FEL amplifier for different electron and optical beam parameters using a one-dimensional code. The advantages of increasing the peak current are clearly shown. Finally, they present results of their analysis of the transient stimulated Raman scattering analysis and its effect on both up and down links.

31712 (DOE/FTR–9013257) **[International conference on synchrotron radiation application, with visits to Beijing, Hefei, and Shanghai, China, April 30–May 18, 1989]: Foreign trip report.** Takacs, P.Z. Brookhaven National Lab., Upton, NY (USA). 30 May 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89013257/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of this trip was to present an invited talk on the development of metrology instrumentation for grazing incidence optics to the International Conference on Synchrotron Radiation Application; to visit various optics laboratories and assess the current state of Chinese optical metrology and fabrication technology; and to continue a cultural and scientific exchange with collaborators who have visited and worked in my laboratory. Details of these presentations are given in this paper.

31713 (FNAL/C–89/89) **Coherent betatron instability driven by electrostatic separators: Stability analysis of the Tevatron.** Harfoush, F.A.; Bogacz, S.A. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890335–167: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012371/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper outlines possible intensity limits due to the coherent betatron motion for the upgraded Tevatron with the electrostatic separators. Numerical simulation shows that this new vacuum chamber structure dominates the high frequency part of the coupling impedance spectrum and more likely will excite a slow head-tail instability. A simple stability analysis yields the characteristic growth-time of the unstable modes. 4 refs., 4 figs., 1 tab.

31714 (FNAL/C–89/94) **Orbital dynamics in the Tevatron double helix.** Michelotti, L.; Saritepe, S. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890335–187: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013084/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

A key feature of the Tevatron upgrade is the placement of proton and anti-proton bunches on the branches of a double helix which winds around the current closed orbit. Electrostatic separators will transfer the bunches on and off the double helix so that they experience head-on collisions only at the experimental areas, BO and DO, all other encounters occurring at large transverse separation. In this way the number of bunches, and the luminosity, can be increased without a proportional growth in the beam-beam tune shift. The scenario raises a number of beam dynamics issues, especially the consequences of sampling magnetic fields far from the magnets' center lines, and the effects of the long-range beam-beam interaction. This report presents the results of (admittedly incomplete) calculations and simulations done to date to explore: a Fermilab team have been studying, both experimentally and theoretically, but we shall not review those efforts here. The constraint of a page limit has forced us to bound this discussion rather stringently, but a more complete paper will be available as a Fermilab Technical Memo. 7 refs., 7 figs.

31715 (FNAL/C–89/103) **Understanding and improving the high field orbit in the Fermilab Booster.** Chao, Y.; Ketcham, L.; Moore, C.D. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890335–186: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013085/JAW. Available from NTIS, PC A02/MF A01 - OSTI.

With the implementation of the BPM system in the Fermilab Booster, complete survey data of the main magnets have been employed to determine magnet moving schemes to correct the high field orbit at 8 GeV kinetic energy and to understand the global pattern of the high field orbit in both planes. Considerable success has been achieved in the former task. We also obtained reasonable understanding in the later effort, given the multitude of factors that have to be dealt with. In this paper an account is given of the survey record, the orbit correction exercise, and the effort to reconstruct the high field orbit based on the survey records. 2 refs., 7 figs., 1 tab.

31716 (IFVE-OUNK–88-55) **Electromagnetic radiation shaping in a plane ondulator with groved pole surface.** Smolyakov, N.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 12p. (In Russian). Order Number DE89616999/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The dipole electromagnetic radiation in azimuthally nonuniform magnetic field is studied. The effect of the magnetic system configuration on the radiation spectral distribution is analyzed. The ondulator radiation is shown to be effectively generated in the magntic system with grooved pole surfaces, the optimal geometry of the latter being calculated. The spectral and angular distribution of ondulator radiation in such systems is also obtained. 16 refs.; 4 figs.

31717 (IYaF–88-25) **Negative differential resistance of electron diode in magnetic field.** Astrelin, V.T.; Kotel'nikov, I.A.; Sinitskij, S.L. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 11p. (In Russian). Order Number DE89617000/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

It is shown that under certain conditions the volt-ampere characteristic o planar vacuum diode in magnetic field has S-form which is typical for electronic devices with negative differential resistance. It means that at fixed voltage the diode may turn up in one of the few states (some of them are unstable) with different values of the diode current. The phenomenon takes place in a comparatively narrow range of voltage and only when th angle between the direction of the magnetic field and the surface of the cathode is not greater than 8,5 deg. Probably due to this reason the negative resistance of the vacuum diode and associated phenomena (such as generation of oscillations) are not found in experiment up to now. 3 refs.; 6 figs.

31718 (IYaF–88-80) **Theory of ion deceleration in magnetized temperature-anisotropic electron plasma.** Davidovskij, V.G. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 50p. (In Russian). Order Number DE89614270/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Method of electron cooling is based on cooling of "hot" beam of heavy charged particles(ions) by a "cold" accompanying electron beam. The process of ion deceleration was considered in approximation of pairing collisions, and the effect of surrounding electron plasma on collision process was considered by introduction of cutting of pairing Coulomb interaction on Debye radius. Expressions of longitudinal dielectric permittivity of electron plasma for various cases are presented. The known formulae in dynamic approximation were used to obtain expressions and plots for energy losses and ion deceleration force in the maximum-magnetized electron plasma. Formulae for energy losses and ion deceleration force in magnetized temperature-anisotropic electron plasma with two-Maxwellian rate distribution were derived. Formulae for the cases of nonmagnetized temperature-anisotropic plasma were derived, using limiting transition to the zero magnetic field. 27 refs.; 25 figs.

31719 (LAL-RT–88-06) **Depolarization enhancement due to the energy spread.** Buon, J. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Jul 1988. 7p. Order Number DE89776420/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

A new semiclassical and stochastic model of spin diffusion is used to obtain numerical predictions for depolarization enhancement due to beam energy spread. It confirms the results of previous models. For LEP, at Z/sub 0/energy, the enhancement is of the order of a few units and increases very rapidly with the energy spread as it would be the case if wigglers would be used. This effect makes more difficult to obtain a high degree of polarization.

31720 (LA-UR–89-1550) **Longitudinal emittance in high-current ion accelerators.** Wangler, T.P.; Bhatia, T.S.; Neuschaefer, G.H.; Pabst, M. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by DOD;DOE/DP. DOE Contract W-7405-ENG-36. (CONF-890335–176: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012609/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The control of longitudinal emittance in an ion linear accelerator is important for minimizing both chromatic aberrations and beam halo. The root-mean-square (rms) longitudinal emittance grouth can result from either the nonlinear rf focusing fields or the nonlinear space-charge fields. We will present conclusions based on numerical beam-dynamics studies for both the radio-frequency quadrupole (RFQ), and the drift-tube linac (DTL). We will discuss the scaling of longitudinal emittance produced during the adiabatic bunching in an RFQ and will show the benefits of ramped DTL accelerating field designs to maintain high longitudinal focusing strength with increasing particle energy. 15 refs., 8 figs.

31721 (LBL–25961) **Vertically integrated simulation tools for self-consistent tracking and analysis.** Forest, E.; Nishimura, H. Lawrence Berkeley Lab., CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890335–179: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012630/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A modeling, simulation and analysis code complex, the Gemini Package, was developed for the study of single-particle dynamics in the Advanced Light Source (ALS), a 1–2 GeV synchrotron radiation source now being built at Lawrence Berkeley Laboratory. The purpose of this paper is to describe the philosophy behind the package, with special emphasis on our vertical approach. 8 refs., 2 figs.

31722 (LBL–27092) **On the re-acceleration of bunched beams.** Whittum, D.H.; Sessler, A.M.; Craig, G.D.; DeFord, J.F.; Yu, David U.L. Lawrence Berkeley Lab., CA (USA). Feb 1989. 15p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890197–10: Advanced accelerator concepts workshop, Lake Arrowhead, California, USA, 9-13 Jan 1989). Order Number DE89012766/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We examine the re-acceleration of a bunched beam through a linear induction accelerator (LIA) cavity, with attention to the energy lost through coupling to the TM modes of the structure. We find that the energy lost at 1 kA peak current is a small fraction of the boost which the LIA is designed to impart. We discuss implications for a Relativistic Klystron or Free Electron Laser (FEL) version of the Two-Beam Accelerator (TBA). 18 refs., 5 figs., 1 tab.

31723 (SLAC-PUB–4835) **Rollfix—An adiabatic roll transition for the SLC [Stanford Linear Collider] Arcs.** Bambade, P.; Brown, K.; Fieguth, T.; Hutton, A.; Ritson, D.; Sands, M.; Toge, N. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Feb 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–154: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012790/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The SLC Arcs were rolled at achromat boundaries to follow the terrain of the SLAC site. This makes the linear optics sensitive to systematic gradient errors, from which severe cross-plane coupling effects may arise. As a partial correction, a smoother roll transition was introduced which relieves much of this sensitivity. We present an evaluation of this scheme and report on the observed improvements. 18 refs., 10 figs.

31724 (SLAC-PUB–4872) **Transverse and longitudinal coupled bunch instabilities in trains of closely spaced bunches.** Thompson, K.A.; Ruth, R.D. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–157: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012781/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Damping rings for the next generation of linear collider may need to contain several bunch trains within which the bunches are quire

closely spaced (1 or 2 RF wavelengths). Methods are presented for studying the transverse and longitudinal coupled bunch instabilities, applicable to this problem and to other cases in which the placement of the bunches is not necessarily symmetric. 5 refs., 1 fig.

31725 (SLAC-PUB–4898) **Dynamics of an electron in an rf gap.** Farkas, Z.D.; Wilson, P.B. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–159: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012280/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of this calculation is to understand the limitation on the energy transfer efficiency of an electron beam to the rf output cavity of a klystron or a lasertron. An output cavity with drift tubes is modeled in this calculation by a region of constant amplitude rf field with exponentially decreasing entrance and exit fringing fields. The exit velocity of an electron traversing such a gap is examined as a function of entrance phase for various values of the ratio of the peak rf cavity voltage to electron entrance voltage. Depending on this ratio, the dynamics of the electron motion can become quite complex. For a gap with fringe fields it is found that, even if the gap voltage and phase are optimized, the maximum energy that can be extracted from a short bunch is always significantly less than 100%. The case in which the electron is created with zero velocity in the gap, and subsequently leaves the gap having extracted energy from the rf field, is also treated. 4 refs., 10 figs.

31726 (SLAC-PUB–4924) **The optical design of the spin manipulation system for the SLAC Linear Collider.** Fieguth, T.H. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–148: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012272/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The optical design of the beam transport lines between the SLAC Linac and the electron damping ring and the design of part of the Linac lattice itself will be modified to accommodate three superconducting solenoids for the purpose of manipulating the polarization of the electron beam. In order to allow arbitrary orientation of the polarization vector, this design will be capable of compensating the fields of two independent solenoids for arbitrary strengths ranging to 7.0 T-m. The method of dealing with the coupling of the betatron functions and the method of handling both the electron and positron beams in the common region are discussed. 8 refs., 5 figs.

31727 (SLAC-PUB–4933) **Construction of symplectic full-turn maps by application of an arbitrary tracking code.** Warnock, R.L. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–146: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012270/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A map to describe propagation of particles through any section of a nonlinear lattice may be represented as a Taylor expansion about the origin in phase space. Although the technique to compute the Taylor coefficients has been improved recently, the expansion may fail to provide adequate accuracy in regions where nonlinear effects are substantial. A representation of the map in angle-action coordinates, with the angle dependence given by a Fourier series, and the action dependence by polynomials in $I^{1/2}$, may be more successful. Maps of this form are easily constructed by taking Fourier transforms of results from an arbitrary symplectic tracking code. Examples are given of one-turn and two turn maps for the SLC North Damping Ring in a strongly nonlinear region. Results for accuracy and speed of evaluation of the maps are quite encouraging. It seems feasible to make accurate maps for the SSC by this method. 9 refs., 1 tab.

31728 (SLAC-PUB–4934) **Beam dynamics with the Hamilton-Jacobi equation.** Gabella, W.E.; Ruth, R.D.; Warnock, R.L. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–145: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012269/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We describe a non-perturbative method to solve the Hamilton-Jacobi equation for invariant surfaces in phase space. The problem is formulated in action-angle variables with a general nonlinear perturbation. The solution of the Hamilton-Jacobi equation is regarded as the fixed point of a map on the Fourier coefficients of the generating function. Periodicity of the generator in the independent variable is enforced with a shooting method. We present two methods for finding the fixed point and hence the invariant surface. A solution by plain iteration is economical but has a restricted domain of convergence. The Newton iteration is costly but yields solutions up to the dynamic aperture. Examples of lattices with sextupoles for chromatic correction are discussed. 10 refs., 5 figs., 1 tab.

31729 (UCRL–99593) **Aligning the magnetic field of a linear induction accelerator with a low-energy electron beam.** Clark, J.C.; Deadrick, F.J.; Kallman, J.S.; Klingmann, J.; Paul, A.C.; Tien, S.S.; Turner, W.C. Lawrence Livermore National Lab., CA (USA). 10 Mar 1989. 5p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. (CONF-890335–184: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012932/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Experimental Test Accelerator II (ETA-II) linear induction accelerator at Lawrence Livermore National Laboratory uses a solenoid magnet in each acceleration cell to focus and transport an electron beam over the length of the accelerator. To control growth of the corkscrew mode the magnetic field must be precisely aligned over the full length of the accelerate. Concentric with each solenoid magnet is sine/cosmic-wound correction coil to steer the beam and correct field errors. A low-energy electron probe traces the central flux line through the accelerator referenced to a mechanical axis that is defined by a copropagating laser beam. Correction coils are activated to force the central flux line to cross the mechanical axis at the end of each acceleration cell. The ratios of correction coil currents determined by the low-energy electron probe are then kept fixed to correct for field errors during normal operation with an accelerated beam. We describe the construction of the low-energy electron probe and report the results of experiments we conducted to measure magnetic alignment with and without the correction coils activated. 5 refs., 3 figs.

31730 **Observation of beam-beam deflections at the interaction point of the SLAC Linear Collider.** Bambade, P. (Stanford Linear Acclerator Center, Stanford University, Stanford, California 94309(US)); Erickson, R.; Koska, W. A.; Kozanecki, W.; Phinney, N.; Wagner, S. R. *Physical Review Letters (USA),* 62(25): 2949-2952 (19 Jun 1989).

We report the first direct observation of the electromagnetic deflection ofhigh-energy electron and positron beams as they pass each other with smallimpact parameters. Measurements of the deflection amplitude are found inagreement with theoretical expectations. This phenomenon, which is sensitiveboth to the relative position of the two beams and to their transverse sizes,has been used successfully to optimize and maintain collisions at theinteraction point of the SLAC Linear Collider.

4303 Auxiliaries and Components

Refer also to citation(s) 31723, 31851, 31853, 31855, 31869, 31873, 32874, 32918, 32919, 32921, 32924, 32931

31731 (CEA-CONF–9628) **Requirements of high-surface electric fields for high-brightness FeI injectors.** Dei-Cas, R.; Joly, S.; Cocu, F.; Frehaut, J.; Leboutet, H. CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France). 1988. 3p. (CONF-880687–: 13. international symposium on discharges and electrical insulation in vacuum, Paris, France, 27-30 Jun 1988). Order Number DE89776486/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

For FEL operation, the advantages of photocathodes over usual thermionic cathodes for the emission of electrons with the required

properties are presented. Simulation codes have been used to design a photo-injector prototype for testing the highest surface electric fields an RF gun cavity could sustain at 144 MHz.

31732 (CONF-8709217–5) **New fast tuning system for the Atlas Accelerator.** Zinkann, G. Argonne National Lab., IL (USA). 1987. 4p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From SNEAP conference; Tallahassee, Florida, USA; 27 Sep - 2 oct 1987. Order Number DE89012689/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper will discuss field level limitations for on-line operation of the Argonne superconducting split-ring resonators. It also describes development of a new fast tuning system for the split-ring superconducting resonators. 1 ref., 1 fig.

31733 (CONF-8905121–2) **The development of a laser-driven spin-polarized dieuterium target.** Phelps, C.W. Argonne National Lab., IL (USA). 1989. 6p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From National conference of undergraduate research; San Antonio, Texas, USA; May 1989. Order Number DE89012415/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

As an alternative to standard technique for producing a polarized deuterium target, we are developing an optically pumped spin-polarized deuterium gas target for use in the Soviet VEPP-3 electron storage ring. We polarize deuterium through spin exchange with an optically pumped alkali gas in storage cell. There are many important factors affecting the deuterium polarization, two of which are the phenomenon of radiation trapping, and coverage of the Doppler-broadened absorption peaks of the alkali. A technique for determining the amount of polarization of deuterium in the cell is also mentioned. 5 refs.

31734 (DOE/ER/40150–68-Rev.) **LEP and CEBAF polarimeters: Revision.** Burkert, V.; Rossmanith, R.; Placidi, M. Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility. 1988. 8p. Sponsored by DOE Energy Research. DOE Contract AC05-84ER40150. (CONF-880983–36-Rev.: 8. international symposium on high energy spin physics, Minneapolis, Minnesota, USA, 12-17 Sep 1988;CEBAF-PR–89-010-Rev.). Order Number DE89012227/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper gives an overview on high energy electron (positron) polarimeters by describing in more detail the plans for the LEP polarimeter and the CEBAF polarimeters. Both LEP and CEBAF will have laser polarimeters. In addition CEBAF will be equipped with a Møller polarimeter (for currents below 1μA). 4 refs., 10 figs.

31735 (DOE/FTR–9011587) **[Visit to Bruker Analytische Messtechnik to expedite delivery of the AGS Booster Quadrupole Magnet Coils, Karlsruhe, W. Germany, February 16–March 4, 1989]: Foreign trip report.** Koehler, J.T. Brookhaven National Lab., Upton, NY (USA). 5 May 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89011587/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary purpose of this visit to Bruker was to expedite delivery of the AGS Booster Quadrupole Magnet Coils by witnessing all manufacturing operations and acceptance tests. In addition, inquiries were to be made about bi-polar power supplies for the AGS Booster. The status of work on AGS magnet coils under BNL purchase order number 311261 was to be investigated. The progress of magnets for the Physics Department under BNL purchase order No. 416027 was to be investigated.

31736 (DOE/FTR–9012800) **[Coil production facilities, Karlsruhe, Germany and Bagneux, France, May 8–10, 1989]: Foreign trip report.** Rodger, E. Brookhaven National Lab., Upton, NY (USA). 22 May 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89012761/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The status of coil manufacture at the two companies was observed. Coil testing was witnessed, and photos were taken of finished coils and coils in process. Several areas of concern were discussed; these related to delivery problems at Bruker and coil construction at Sigmaphi.

31737 (DOE/FTR–9013610) **[Developments in data acquisition hardware and software, CERN, Geneva, Switzerland, Frankfurt W. Germany, Oxford, UK, April 4-15, 1989]: Foreign trip report.** LeVine, M.J. Brookhaven National Lab., Upton, NY (USA). 24 Apr 1989. 7p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89013610/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

CERN visit included conversations with Dr. Christoph Eck and Mr. Timothy Charity of DD Division concerning new hardware architectures for data acquisition for the coming decade. The future of VMEbus, Futurebus, Fastbus, and VXIbus in the context of data acquisition was discussed, as well as support currently available for various microprocessor families, including several RISC architectures. Features of OS9, an operating system in use in two LEP experiments, were discussed. Discount schedules for DEC software and hardware at CERN were compared with discounts available at US DOE laboratories.

31738 (FEI–1887) **Development of charging belt for electrostatic accelerators.** Romanov, V.A.; Fejgin, A.S.; Krivenkov, A.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst. 1988. 16p. (In Russian). Order Number DE89617006/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

To provide for designed operating regimes of the EGP-15 accelerator it is necessary that the charging system provided for short circuit current of no lower than 300 μA not appear to be the source of the accelerator high-voltage structure contamination and possess increased electroinsulation properties. When developing the new charging system named ICD-300 the attention was mainly concentrated on these questions. Results of development, breadboarding and bench tests of conducting charging belt for electrostatic accelerators with controlled charging current are illustrated. Its mechanical strength and durability calculations are presented. 6 refs.; 3 figs.; 8 tabs.

31739 (GSI–89-07) **Fine focusing of intense heavy ions for the production of hot dense matter.** Heimrich, B. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Giessen Univ. (Germany, F.R.). Feb 1989. 104p. (In German). Order Number DE89774820/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

In order to perform the first experimental studies on the interaction of intense ion beams with matter an electrostatic quadrupole doublet was developed which focuses the space-charge carrying ion beam of the RFQ accelerator at the GSI Darmstadt on an area of 1 mm/sup 2/. By an especially manufactured target holder this intense ion beam was stopped in tungsten targets and the first plasma induced by heavy ions was produced. Electrons and ions which are emitted from the plasmas have been spectroscoped by an especially for this fabricated spectrometer in their energy and time distribution in the eV region by which first comparisons between theory and praxis on the heating of dense matter by intense ion beams could be made. (orig./HSI).

31740 (GSI–89-32(prepr.)) **Filamentation of phase space and coherent noise for beams injected into storage rings.** Hofmann, I. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Mar 1989. 13p. Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

Initial filamentation of longitudinal phase space of a beam in a storage ring is a natural consequence of the discrete bunch structure of the injected beam. Here we study analytically and computationally a collective mechanism, which causes the filaments to disappear once their number is large enough. The mechanism is a coupling of electrostatic waves on different filaments, which leads to an unstable situation without changing the total momentum width of the beam. At saturation it develops a turbulent phase space motion with strong coherent fluctuations. This process is the faster the higher the density of the injected beam is. For given momentum width the number of filaments required for onset of this instability is inversely proportional to the square root of the current. We suggest

that this phase space turbulence could be observed by strong coherent Schottky signals, which would allow a fast measurement of the incoherent momentum spread.

31741 (IFVE-OEA–88-73) **Control system of magnetic optical element power supplies for some beam channels.** Alferov, V.N.; Vetrov, P.B.; Dan'shin, V.P. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 15p. (In Russian). Order Number DE89617012/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The control system of the magnetic optical element power supplies for some beam channels of the IHEP accelerator, based on the micro-computer "Elektronika-60" and its software are described. The remote control is supplied with three Multidrop Serial Busses (31 consumer per bus). The number of controlled elements can be increased by adding one or more serial busses. 13 refs.; 4 figs.; 3 tabs.

31742 (IFVE-ORI–88-85) **Spectral and angular distributions of charged particles outside biological shielding of the 70 GeV Serpukhov accelerator.** Krupnyj, G.I.; Lebedev, V.N.; Peleshko, V.N.; Rastsvetalov, Ya.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 19p. (In Russian). Order Number DE89617007/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Submitted to the journal At. Ehnerg.

Space, angular and energy distributions of the charged particle of radiation field outside the Serpukhov accelerator shielding at different protons beam energies obtained with the ΔE-E spectrometer are presented. The influence of the accelerating complex operation on the charged particles field shaping outside the concrete and heterogeneous steel-concrete shieldings has been analyzed. The ratios between neutrons and charged particles of the radiation field outside the 70 GeV accelerator shielding have been estimated. 12 refs.; 11 figs.; 4 tabs.

31743 (INIS-SU–79, pp. 3-4) **Start-up of the negative ion injector for the meson factory linear accelerator in the Nuclear Research Institute, Academy of Science, USSR.** Anikejchik, A.M. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij); Golubev, V.A.; Klenov, V.S.; Pronin, O.D.; Yakushev, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

The physical start-up of the negative hydrogen ion injector was conducted in December, 1986, and a H/sup -/ion beam with 750 keV energy, 20 mA pulsed current, 1 Hz pulse repetition frequency was produced. The accelerating tube has two accelerating gaps with electric potential of 250 and 500 kV, respectively. The negative ion source of surface-plasma type operated without cesium supply. The six-channel power supply of the ion source was controlled via fibre-optical communication lines by digital setting. Accelerating voltage with 750 kV pulse amplitude and 80 μs duration was generated by a pulse transformer with a transformation coefficient of 43. The accelerating tube was trained gap by gap. An accelerating beam does not decrease high-voltage strength of the accelerating tube. 3 refs.

31744 (INIS-SU–79, pp. 52-53) **Measuring of spectral composition of the pulse SHF generator signals.** Balakov, V.F. (Moskovskij Ehnergeticheskij Inst., Moscow (USSR)); Buryak, V.S.; Leonov, A.M. and others. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

A method for measuring the level of parasitic oscillations (SO) at the SHF generator output is discussed. The method is based on application of a waveguide oscillation separator (WOS), a set of waveguide transformers and a selective pulse wattmeter. The WOS design is a waveguide assembly consisting of a coupled waveguide (for ground-frequency oscilltions) and a broad waveguide with three measuring channels of equal cross section. The latter are supercritical for ground-frequency oscillations, but have low transient attenuation (1-10dB) for SO. Application of the selective wattmeter and WOS enables to detect SO in the 2-7 harmonics frequency range and in the dynamic range up to 80 dB with error not more than ±2dB. The designed equipment operated reliably at high pulse levels of SHF power (up to 20 MW) and under conditions of a high pulse noise levels. 3 refs.; 2 figs.; 1 tab.

31745 (INIS-SU–79, pp. 54-55) **Ferritor isolator for RF power supply system of a linear accelerator.** Grebenyuk, S.V. (Dnepropetrovskij Gosudarstvennyj Univ., Dnepropetrovsk (Ukrainian SSR)); Yurov, A.A.; Lobzov, L.D. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

A rectifier design on the base of a strip U-calculator is developed and experimentally studied. A working volume of circulator is filled with liquid dielectric, that enables to essentially improve electric design strength and heat removal of energy dissipated in ferrite. To decrease the circulator working frequency in the U-fork region the central strip is made in the form of a decelerating comb-like structure. Cooling of 8SCh ferrite discs, 200x8mm, is realized by forced circulation of liquid dielectric inside the circulator and water in the external loop over the area of ferrite contacts with face vessel covers. Application of a magnetic system for correction of rectifier drift parameters has permitted to stabilize direct and reverse losses within the limits -0.7...-0.35 and -19...-14dB and standing wave ratio is 1.23 in a 20% frequency band at temperature variations from 18 to 120deg C. After forced circulator cooling (by oil or PMS-10 liquid) and magnetic correction system the working level of pulsed power is limited by nonlinear absorption phenomena in ferrites and attains 1.5...2MW at average value of about 30 kW. 2 refs.; 2 figs.

31746 (INIS-SU–79, pp. 21-23) **Ion induction accelerator with collective focusing (IINDUS).** Kiyashko, V.A.; Kornilov, E.A.; Vinokurov, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1987. (In Russian). (CONF-8706388–: 10. All-Union seminar on linear accelerators, Kharkov, Ukrainian SSR, 2-4 Jun 1987). In *Physical experiment technique. Scientific-technical collection.* Order Number DE89780088/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 3(34).

Experimental results on subacceleration of high-current neutralized ion beams in a three-gap linear induction accelerator with collective focusing and magnetic insulating field having acute-angled geometry are presented. At total accelerating voltage up to 540 kV a 2kA ion beam with 0.5 μs pulse duration is detected at the IINDUS accelerator output, and in case of deuteron beams and CD/sub 2/target the neutron yield is about 3x10/sup 9/neutron/pulse. 14 refs.; 3 figs.

31747 (IYaF–88-16) **On geometric focusing of negative hydrogen ions in surface-plasma sources.** Bel'chenko, Yu.I.; Kupriyanov, A.S. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 13p. (In Russian). Order Number DE89617002/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Consideration is given to results of analyzing efficiency of geometric focusing in various modifications of surface-plasma sources (SPS). Analysis was conducted on the basis of numerical simulation of elementary processes in SPS and experimental data. 23 refs.; 8 figs.

31748 (IYaF–88-21) **Ion source with increased service life.** Shamovskij, V.G. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 12p. (In Russian). Order Number DE89617003/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Design of a simple ion source with long service life is described. Gaseous discharge in plasma generator burns between anode with outlet and heated cathode, made of tungsten wire, 1.5 mm in diameter. Additional electrode, being at floating potential is used to reduce thermionic cathode destruction in result of cathode sputtering. This electrode, decreasing sufficiently plasma density near thermionic cathode without change of its emission current, reduces ion flux from plasma on thermionic cathode. This results to sharp decrease of its destruction rate under ion bombardment service life tests of the ion source were conducted for argon during 100 h. Any noticeable destructions of structural components, including thermionic cathode, were not revealed after tests. 6 refs.: 8 figs.

31749 (IYaF–88-41) **Study on pulse characteristics of belt magnetic circuits made of thin transformer steel.** Grishanov, B.I.; Dolgikh, B.P.; Kazarezov, I.V.; Fogel', V.F. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 7p. (In Russian). Order Number DE89614290/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A need in generators of rectangular pulses of gigawatt power, 50 kV voltage, 0.8 μs duration for power supply of pulsed sources of the VLEhPP SHF complex, has arisen. Alongside with other variants the possibility of the generator production on the basis of modulator with a step-up pulse transformer was considered. The basic circuit of the facility and results of investiagtions in microsecond range of pulse characteristics of belt magnetic circuits made of electrotechnical steel 30 and 80 μm thick with electroinsulation coating is described. The effect of technological factors on pulse characteristics of the belt magnetic circuits is studied. 3 refs.; 3 figs.

31750 (JINR–9-88-356) **Methods and systems for diagnostics of electron bunches by synchrotron radiation in infrared range.** Golutvin, I.A.; Mal'tsev, A.A.; Sarantsev, V.P.; Sviridov, V.A. Joint Inst. for Nuclear Research, Dubna (USSR). 1988. 6p. (In Russian). Order Number DE89617014/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Submitted to the Organizing committee of the international conference on the use of synchronous radiation SI-88. Novosibirsk, Aug 1988.

Methods for measuring current, geometric parameters and for estimating ring energy parameters in adgesator using synchrotron radiation of IR range are presented as well as information measuring system created on their base. Spectrum of synchrotron radiation is mainly in IR range (wave length range is $\sim > 1$ mkm). Elements of IR optics are used (high vacuum window made of MgF/sub 2/and 2 m mirror optical channel). Radiation is registered by cooled and operating under room temperature IR detectors prepared from Si, InSb, PbSe. Results of measuring the number of electrons in a ring, equilibrium radius and dimensions of small cross section of ring bunch, angular spread of synchrotron radiation relatively to ring medium plane are presented. 10 refs.; 8 figs.

31751 (KIYI–88-26) **Stable current-to-frequency converter for charged particle beam monitoring.** Urin, V.N. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 7p. (In Russian). Order Number DE89617015/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A stable current-to-frequency converter for beam current measuring, based on a single chip 3 1/2 digit analog-to-digital converter is described. It is suitable for current measuring in 2x10/sup -6/-10/sup -10/A range and has a longterm and thermal stability about 0,1%. 4 refs.; 1 fig.

31752 (LA-UR–89-1497) **Improvements to a transmission-line model of a main-ring cavity.** Swain, G.R. Los Alamos National Lab., NM (USA). 1989. 11p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890299–9: AHF accelerator design workshop, Los Alamos, New Mexico, USA, 20-25 Feb 1989). Order Number DE89012596/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A transmission-line model has been used in the design of a ferrite-tuned prototype rf cavity for a hadron-facility main ring. The computer codes SUPERFISH and MAFIA were used to refine and validate the transmission line model representations for the accelerating gap, the coaxial tee, and the ferrite tuner assembly. 5 refs., 9 figs., 4 tabs.

31753 (LA-UR–89-1571) **Optimization of Resonant Power Supply Circuit.** Karady, G.G.; Thiessen, H.A. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890335–175-Vugraphs: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013208/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A Resonant Power Supply has been proposed to power Rapid Cycling Accelerator magnets. The Resonant Power Supply circuits were studied extensively, but were not optimized. Most designs assume equal choke and magnet inductance, however, the variation of inductance affects both performance and cost of the system. This paper optimizes the Resonant Power Supply Circuit by selecting the most feasible choke inductance. For this optimization, a computer model and an approximate design method were developed. The effect of choke inductance on the components rating and cost was determined. It was found that the increase of choke inductance reduces the maximum and increases the minimum choke current, which leads to a significant increase of system losses. The maximum voltage is independent of the choke inductance. The described change of choke current reduces the current of the Bypass Thyristor Switch and the Capacitor Bank Switch, which results in cost reduction. The increase of choke inductance reduces the size of capacitor banks. The loss increase requires larger Make-up Power Supply and ac supply systems. It also increases the operation costs. The system cost function has a minimum, when the choke inductance is about 1.5–2 times larger than the magnet one. The application of the result will lead to a more economical and efficient Resonant Power Supply. 2 refs., 8 figs., 1 tab.

31754 (LA-UR–89-1572) **Tuning magnet power supply.** Han, B.M.; Karady, G.G.; Thiessen, H.A. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890335–174: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013207/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The particles in a Rapid Cycling Accelerator are accelerated by rf cavities, which are tuned by dc biased ferrite cores. The tuning is achieved by the regulation of bias current, which is produced by a power supply. The tuning magnet power supply utilizes a bridge circuit, supplied by a three phase rectifier. During the rise of the current, when the particles are accelerated, the current is controlled with precision by the bridge which operates a power amplifier. During the fall of the current, the bridge operates in a switching mode and recovers the energy stored in the ferrites. The recovered energy is stored in a capacitor bank. The bridge circuit is built with 150 power transistors. The drive, protection and control circuit were designed and built from commercial component. The system will be used for a rf cavity experiment in Los Alamos and will serve as a prototype tuning power supply for future accelerators. 1 ref., 7 figs.

31755 (LA-UR–89-1573) **New energy replacement method for resonant power supplies.** Karady, G.G.; Thiessen, H.A. Los Alamos National Lab., NM (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890335–173: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013206/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Resonant Power Supply is an economically and technically advanced solution for Rapid Cycling Accelerators. Several papers dealt with the design and operation of these power supplies, however, the energy replacement methods were not discussed in the past. This paper analyzes different energy-replacement methods

and presents a new method. This method uses a 24-pulse converter to regulate the magnet current during flat-top and injection periods and replaces the energy loss by charging the accelerator capacitor bank during the flat-top, reset and injection periods, charge is injected in the circuit during the acceleration period, when it replaces the energy loss. This paper compares the new method with the existing ones. The analyses proved the feasibility of the proposed method. The operation of the proposed method was verified by a model experiment, which showed that the new circuit can be controlled accurately and operates with smaller disturbances to the power line than the existing systems. 2 refs., 6 figs., 1 tab.

31756 (LA-UR–89-1574) **Time and frequency response of beam position monitors at the Los Alamos proton storage ring.** Swain, G.R. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890299–10: AHF accelerator design workshop, Los Alamos, New Mexico, USA, 20-25 Feb 1989). Order Number DE89012770/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A number of beam position monitor (BPM) signals were digitized and recorded for stable and unstable beams in the proton storage ring (PSR) at Los Alamos at the end of the running cycle in October 1988. This paper describes how this was done and presents some examples of the time and frequency responses obtained. 1 ref., 10 figs.

31757 (LA-UR–89-1600) **Tentative design of beam focusing for the AHF linac and transport systems.** Swain, G.R. Los Alamos National Lab., NM (USA). 1989. 10p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890299–7: AHF accelerator design workshop, Los Alamos, New Mexico, USA, 20-25 Feb 1989). Order Number DE89012618/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Proposals for an advanced hadron facility include building afterburner linacs for LAMPF. A first afterburner, Add-on Linac number 1, is proposed to accelerate the beam from 0.8 to 1.6 GeV. The output beam would then be fed to a compressor ring and to another afterburner, Add-on Linac number 2. We make a rough estimate of the transverse focusing strength needed in these linacs, and consider the transport line from the end of the LAMPF 805-MHz linac to the start of Add-on Linac number 1. A rebuncher is needed in this transport line for proper acceptance of the beam into the add-on linac. 2 refs., 4 figs.

31758 (LBL–25424) **The production of beams from solid materials at the LBL ECR source.** Clark, D.J.; Lyneis, C.M. Lawrence Berkeley Lab., CA (USA). Sep 1988. 12p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-880955–5: International conference on the physics of multiply-charged ions, Grenoble, France, 12-14 Sep 1988;CONF-8809290–2). Order Number DE89010387/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Two ovens are described for the feed of vapor from solid materials in the LBL ECR source. A low temperature oven, operating up to 700 ° C, has been used for Li, Mg, P, K, Ca, Ti and Bi. A high temperature oven operating up to 2000°C, has been used for Sc, Fe, Ni, Cu, Ag, La and Tb. At the 1 eμA level the charge states from the oven beams are very close to those from gases. 4 refs., 5 figs., 2 tabs.

31759 (LBL–25610) **A general formalism for quasi-local correction of multipole distortions in periodic transport systems.** Neuffer, D.; Forest, E. Lawrence Berkeley Lab., CA (USA). Jun 1988. 12p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (ESG–47). Order Number DE89013359/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We generalize a new concept of local correction of nonlinearities due to multipole content by giving it a mathematical description. We present a general method which allows for a general reduction of all the distortions produced by a given set of multipole errors. The method can be applied to correct an arbitrary distribution of the errors in any transport system, such as transport lines, linacs, synchrotrons and storage rings. 11 refs., 3 figs., 2 tabs.

31760 (LBL–25951) **Beam impedance of ferrite kicker magnets.** Voelker, F.; Lambertson, G. Lawrence Berkeley Lab., CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890335–181: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012728/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have measured the longitudinal beam impedance of a typical pulsed magnet that will be used in the Advanced Light Source. The magnets are of a ferrite window-frame design with a single plate conductor on each side. Two separate power supplies are used to drive current in opposite directions in the two conductors. The continuity of the ferrite yoke is interrupted by two copper plates 1 mm thick in the center of the top and bottom of the window frame. This increases the reluctance of the magnetic path, and thus decreases the flux which couples the beam. The measurements were made by exciting a 1/8" rod along the beam path through the magnet. This makes a 185 ohm transmission line, and it was terminated in a resistive divider at the exit end. A 3 GHz network analyzer was used to measure S_{21} through the magnet, and longitudinal beam impedance was calculated from this data. The impedance is dominated by two low frequency resonances in the magnet winding and drive current. 8 figs.

31761 (LBL–25953) **Magnetic properties of the ALS [Advanced Light Source] booster synchrotron engineering model magnets.** Keller, R.; Green, M.I.; Hoyer, E.; Koo, Y.M.; Luchini, K.; Marks, S.; Milburn, J.; Nelson, D.H. Lawrence Berkeley Lab., CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890335–180: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013189/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Advanced Light Source (ALS) at Lawrence Berkeley Laboratory is designed to be a third-generation electron storage ring producing high-brightness VUV and X-ray radiation from wiggler and undulator insertion devices. Engineering models of all lattice magnets that are to be installed in the storage ring and its booster synchrotron have been built and are being tested to verify their performance. This paper is concerned with the magnets that form the booster lattice: dipoles, quadrupoles, sextupoles, and corrector dipoles (steerers). After a brief outline of measurement techniques and equipment, the major design parameters of these magnets are listed. Measured effective lengths and multipole field errors are then given for each type. All engineering models meet the specifications, and tracking studies including the measured systematic field errors show acceptable performance of the booster synchrotron; hence the designs are qualified for production. 3 refs., 7 figs., 4 tabs.

31762 (LBL–25986) **Dynamic aperture of the ALS [Advanced Light Source] booster synchrotron.** Kim, C.H.; Nishimura, Hiroshi. Lawrence Berkeley Lab., CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890335–182: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013170/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Effect of the anticipated lattice imperfections on the dynamic aperture of the ALS booster synchrotron were studied using a particle tracking method. The dynamic aperture was found to be sufficiently large at the selected operating points and at the designed repetition rate. 4 refs., 4 figs., 3 tabs.

31763 (LBL–26244) **Development of superconducting strand and cable with improved properties for use in SSC [Superconducting Super Collider] magnets.** Scanlan, R.M. Lawrence Berkeley Lab., CA (USA). Feb 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890270–17: International industrial symposium on the super collider, New Orleans, Louisiana, USA, 8-10 Feb 1989). Order Number DE89012627/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The critical current requirement for the NbTi superconductor strand was set at 2750 A/mm^2 (5 T, 4.2 K) in the SSC Conceptual Design, compared with a value of 1800 A/mm^2 which was specified for the strand used in the Tevatron dipoles. In addition, a filament diameter of 5 μm, instead of the 9 μm diameter used in the Tevatron, was chosen to reduce field distortion at injection. In order to

meet the requirements for field homogeneity, the dimensional requirements for both strand and cable were also tightened. The technical solutions employed to achieve these improved properties and the resulting specifications will be discussed. 9 refs.

31764 (LBL–26247) **Straight ends for superconducting dipole magnet using "constant perimeter" geometry.** Royet, J. Lawrence Berkeley Lab., CA (USA). Feb 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890270–15: International industrial symposium on the super collider, New Orleans, Louisiana, USA, 8-10 Feb 1989). Order Number DE89013429/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The ends of the SSC Dipole magnets are a very critical aspect of the superconducting cable windings needed for this large project. The internal coils, where the radius at the pole is as small as 3/10 of an inch for the first turn, are difficult to form with the very stiff cable, and a high tension is needed. The curing operation on the coils is performed in a heated forming press which applies an important additional stress on the superconducting wire and insulation. A new design of this sensitive region of the magnets was performed at LBL, and several prototypes were built and tested. In this paper the construction method used to solve some of the most critical problems is exposed along with a description of the experimental work in progress. 3 refs., 2 figs.

31765 (LBL–26282) **Training of LBL-SSC model dipole magnets at 1.8 K.** Gilbert, W.S.; Althaus, R.; Benjegerdes, R.; Caspi, S.; Peters, C.; Rechen, J.; Royet, J.; Scanlan, R.; Taylor, C.; Wandesforde, A. Lawrence Berkeley Lab., CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890335–177: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89013428/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We present the 1.8K training behavior of SSC Magnets, several of which have reached a peak current of 9400 A; a central field of 9 Tesla. For the SSC Project, more than 30 one meter long dipole magnets have been built and tested. The test results for the 4.3K operation have been presented previously. Magnet operation, primarily reaching design field without premature training, is expected to be superior in superfluid helium at 1.8K as compared with helium I at 4.3K. Not only is the critical current increased at the lower temperature, but the heat transfer is much improved. LBL has had an operating helium II facility for nine years and our standard test sequence has been to check for training in helium I at 4.3K and then cool the system down to 1.8K and train the magnet to its new, high limit. Because the mechanical forces are much greater at the higher currents and fields achieved at the lower temperature, information has been obtained on the adequacy of the mechanical design. Even for those magnets in which training quenches occurred in the inner layer at 4.3K, many of the quenches at 1.8K occurred in the outer layer. 10 refs., 8 figs.

31766 (LBL–27062) **Passive superconductor: A viable method of controlling magnetization multipoles in the SSC dipole.** Green, M.A. Lawrence Berkeley Lab., CA (USA). Feb 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890270–16: International industrial symposium on the super collider, New Orleans, Louisiana, USA, 8-10 Feb 1989). Order Number DE89013432/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At injection, the magnetization of the superconductor produces the dominant field error in the SSC dipole magnets. The field generated by magnetization currents in the superconductor is rich in higher symmetric multipoles (normal sextupole, normal decapole, and so on). Pieces of passive superconductor properly located within the bore of the dipole magnet can cancel the higher multipoles generated by the SSC dipole coils. The multipoles generated by the passive superconductor (predominantly sextupole and decapole) are controlled by the angular and radial location of the superconductor, the volume of superconductor, and the size of the superconducting filaments within the passive conductor. This paper will present the tolerances on each of these factors. The paper will show that multipole correction using passive superconductor is in general immune to the effects of temperature and magnetization decay due to flux creep, provided that dipole superconductor and the passive correction superconductor are properly specified. When combined with a lumped correction system, the passive superconductor can be a viable alternative to continuous correction coils within the SSC dipoles. 20 refs., 8 figs., 2 tabs.

31767 (SAND–89-0298) **Numerical simulations of RADLAC, IBEX, Recirc, and PT0 in 1988.** Poukey, J.W. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 87p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE89000868/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The particle code MAGIC and the trajectory code TRAJ were used to model diodes, gaps, and conditioning cells for several of Sandia's linear electron accelerators. In this report we summarize the main results obtained and discuss their significance. 29 refs., 50 figs., 10 tabs.

31768 (SLAC-PUB–4719-Rev.) **Transient analysis of multicavity klystrons.** Lavine, T.L.; Miller, R.H.; Morton, P.L.; Ruth, R.D. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–155: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012792/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We describe a model for analytic analysis of transients in multicavity klystron output power and phase. Cavities are modeled as resonant circuits, while bunching of the beam is modeled using linear space-charge wave theory. Our analysis has been implemented in a computer program which we use in designing multicavity klystrons with stable output power and phase. We present as examples transient analyses of a relativistic klystron using a magnetic pulse compression modulator, and of a conventional klystron designed to use phase shifting techniques for rf pulse compression. 14 refs., 4 figs.

31769 (SLAC-PUB–4743) **High-yield positron systems for linear colliders.** Clendenin, J.E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–153: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012791/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Linear colliders, such as the SLC, are among those accelerators for which a high-yield positron source operating at the repetition rate of the accelerator is desired. The SLC, having electron energies up to 50 GeV, presents the possibility of generating positron bunches with useful charge even exceeding that of the initial electron bunch. The exact positron yield to be obtained depends on the particular capture, transport and damping system employed. Using 31 GeV electrons impinging on a W-type converter phase-space at the target to the acceptance of the capture rf section, the SLC source is capable of producing, for every electron, up to two positrons within the acceptance of the positron damping ring. The design of this source and the performance of the positron system as built are described. Also, future prospects and limitations for high-yield positron systems are discussed. 11 refs., 5 figs., 3 tabs.

31770 (SLAC-PUB–4850) **Magnets for high energy colliders.** Spencer, J.; Stucki, H. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–166: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012788/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The problem of producing, preserving and stably colliding low emittance bunches for long periods of time is a formidable problem involving questions of jitter, dynamic alignment and reproducibility associated with magnetic and mechanically hysteresis. Permanent magnets provide ideal solutions for lower capital and operating costs. Because they are light in weight, compact and require no power or cooling they are easy to use, stable and uniquely reliable. With their low permeability this implies a minimal impact on the surrounding environment and vice versa. For example, they are ideal

for final focus systems embedded in particle detectors with strong solenoidal fields while their strength and compactness minimizes the solid angle they subtend around the interaction point (IP) as well as their target thickness along the beam line. We discuss calculations there $\vec{B}$ is a nonlinear, anisotropic function of $\vec{H}$. The results explain discrepancies observed measurement and calculation of permanent magnet systems and indicate good multipoles are possible with far higher strengths than previously obtained. We extend previous calculations on the obtainable gradients for different types of quadrupoles down to 1 mm bore radii where 2000 T/m appears possible with conventional designs and available materials. We discuss why much higher gradients are possible by the same means. Additional specifications for PM manufacturers are recommended. 14 refs., 5 figs.

31771 (SLAC-PUB–4861) **Relativistic klystrons.** Allen, M.A.; Azuma, O.; Callin, R.S.; Deruyter, H.; Eppley, K.R.; Fant, K.S.; Fowkes, W.R.; Herrmannsfeldt, W.B.; Hoag, H.A.; Koontz, R.F. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (UCRL–100634;LBL–27147;CONF-890335–167: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012785/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Experimental work is underway by a SLAC-LLNL-LBL collaboration to investigate the feasibility of using relativistic klystrons as a power source for future high gradient accelerators. Two different relativistic klystron configurations have been built and tested to date: a high grain multicavity klystron at 11.4 GHz and a low gain two cavity subharmonic buncher driven at 5.7 GHz. In both configurations power is extracted at 11.4 GHz. In order to understand the basic physics issues involved in extracting RF from a high power beam, we have used both a single resonant cavity and a multi-cell traveling wave structure for energy extraction. We have learned how to overcome our previously reported problem of high power RF pulse shortening, and have achieved peak RF power levels of 170 MW with the RF pulse of the same duration as the beam current pulse. 6 refs., 3 figs., 3 tabs.

31772 (SLAC-PUB–4865) **Damped accelerator structures for future linear $e^{\pm}$ colliders.** Deruyter, H.; Hoag, H.A.; Lisin, A.V.; Loew, G.A.; Palmer, R.B.; Paterson, J.M.; Rago, C.E.; Wang, J.W. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–168: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012784/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes preliminary work on accelerator structures for future TeV linear colliders which use trains of $e^{\pm}$ bunches to reach the required luminosity. These bunch trains, if not perfectly aligned with respect to the accelerator axis, induce transverse wake field modes into the structure. Unless they are sufficiently damped, these modes cause cummulative beam deflections and emittance growth. The envisaged structures, originally proposed by R. B. Palmer, are disk-loaded waveguides in which the disks are slotted radially into quadrants. Wake field energy is coupled via the slots and double-ridged waveguides into a lossy region which is external to the accelerator structure. The requirement is that the Q of the HEM_{11} mode be reduced to a value of less than 30. The work done so far includes MAFIA code computations and low power rf measurements to study the fields. A four-cavity $2\pi/3$ mode standing-wave structure has been built to find whether the slots lower the electric breakdown thresholds below those reached with conventional disk-loaded structures. We set out to assess the microwave properties of the structure and the problems which might be encountered in fabricating it. 4 refs., 7 figs.

31773 (SLAC-PUB–4866) **Rf breakdown studies in copper electron linac structures.** Wang, J.W.; Loew, G.A. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–169: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012783/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents a summary of rf breakdown-limited electric fields observed in experimental linac structures at SLAC and a discussion of how these experiments can be interpreted against the background of existing, yet incomplete, theories. The motivation of these studies, begun in 1984, is to determine the maximum accelerating field gradients that might be used safely in future $e^{\pm}$ colliders, to contribute to the basic understanding of the rf breakdown mechanism, and to discover if a special surface treatment might make it possible to supersede the field limits presently reachable in room temperature copper structures. 6 refs., 4 figs., 1 tab.

31774 (SLAC-PUB–4867) **Anomalous electron loading in SLAC 5045 klystron and relativistic klystron input cavities.** Koontz, R.F.; Fowkes, R.W.; Lavine, T.L.; Miller, R.H.; Vlieks, A.E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–156: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012782/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Recent studies of RF breakup and instability in the SLAC 5045 klystrons have revealed that many production klystrons show loading of the input cavity by low energy electrons even under cold cathode no beam conditions. Sometime after the onset of the RF drive pulse, the input cavity absorbs a portion of the incident RF drive that would otherwise be reflected from the not-beam-loaded cavity. This power absorption is a function of drive level, and of axial magnetic field surrounding the cavity. No power absorption is present when the axial magnetic field is zero. This same phenomenon has been observed in the input cavity of relativistic klystron experiments being conducted as part of the SLAC-LBL-LLNL development program. The phenomenon may be associated with RF breakup and RF instability in SLAC 5045 klystrons, and with unstable pulse shortening in the relativistic klystron experiments. This paper outlines some old and new observations of microwave beam device malfunctions that probably are associated with low energy electron fluxes in the vacuum environments of microwave power devices. 2 refs., 5 figs.

31775 (SLAC-PUB–4883) **Design calculations and measurements of a dipole magnet with Permendur pole pieces.** Early, R.A.; Cobb, J.K.; Oijala, J.E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–158: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012281/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A redesign of the SLC South Linac-to-Ring beam line required that the width of a good field of three of the bending magnets be increased while utilizing the same yoke and coils. Further requirements were that the resulting magnets should have the same strength at two different operating currents as the original magnets. The idea of replacing the steel poles with pole pieces of the high permeability material Permendur was investigated. Design calculations were done using TOSCA and POISSON. An existing prototype magnet was modified with Permendur poles, and magnetic measurements were done. The new magnets were completed, and measurements agreed well with the calculations. 4 refs., 14 figs.

31776 (SLAC-PUB–4902) **Beam-based alignment technique for the SLC [Stanford Linear Collider] linac.** Adolphsen, C.E.; Lavine, T.L.; Atwood, W.B.; Himel, T.M.; Lee, M.J.; Mattison, T.S.; Pitthan, R.; Seeman, J.T.; Williams, S.H.; Trilling, G.H. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (LBL–27057;CONF-890335–160: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012279/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Misalignment of quadrupole magnets and beam position monitors (BPMs) in the linac of the SLAC Linear Collider (SLC) cause the electron and positron beams to be steered off-center in the disk-loaded waveguide accelerator structures. Off-center beams produce wakefields which limit the SLC performance at high beam intensities by causing emittance growth. Here, we present a general method for simultaneously determining quadrupole magnet and BPM offsets using beam trajectory measurements. Results from the application of

the method to the SLC linac are described. The alignment precision achieved is approximately 100 μm, which is significantly better than that obtained using optical surveying techniques. 2 refs., 4 figs.

31777 (SLAC-PUB–4921) **Precision synchrotron radiation detectors.** Levi, M.; Rouse, F.; Butler, J.; Jung, C.K.; Lateur, M.; Nash, J.; Tinsman, J.; Wormser, G.; Gomez, J.J.; Kent, J. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (LBL–26976;CONF-890335–150: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012274/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Precision detectors to measure synchrotron radiation beam positions have been designed and installed as part of beam energy spectrometers at the Stanford Linear Collider (SLC). The distance between pairs of synchrotron radiation beams is measured absolutely to better than 28 μm on a pulse-to-pulse basis. This contributes less than 5 MeV to the error in the measurement of SLC beam energies (approximately 50 GeV). A system of high-resolution video cameras viewing precisely-aligned fiducial wire arrays overlaying phosphorescent screens has achieved this accuracy. Also, detectors of synchrotron radiation using the charge developed by the ejection of Compton-recoil electrons from an array of fine wires are being developed. 4 refs., 5 figs., 1 tab.

31778 (SLAC-PUB–4922) **Precision measurements of the SLC [Stanford Linear Collider] beam energy.** Kent, J.; King, M.; Von Zanthier, C.; Watson, S.; Levi, M.; Rouse, F.; Bambade, P.; Erickson, R.; Jung, C.K.; Nash, J. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (LBL–26977;CONF-890335–149: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012273/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A method of precisely determining the beam energy in high energy linear colliders has been developed using dipole spectrometers and synchrotron radiation detectors. Beam lines implementing this method have been installed on the Stanford Linear Collider. An absolute energy measurement with an accuracy of better than $\delta E/E = 5 \times 10^{-4}$ can be achieved on a pulse-to-pulse basis. The operation of this system will be described. 4 refs., 3 figs., 1 tab.

31779 (SLAC-PUB–4925) **Long ion chamber systems for the SLC [Stanford Linear Collider].** Rolfe, J.; Gearhart, R.; Jacobsen, R.; Jenkins, T.; McCormick, D.; Nelson, R.; Reagan, D.; Ross, M. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–147: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012271/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A Panofsky Long Ion Chamber (PLIC) is essentially a gas-filled coaxial cable, and has been used to protect the Stanford Linear Accelerator from damage caused by its electron beam, and as a sensitive diagnostic tool. This old technology has been updated and has found renewed use in the SLC. PLIC systems have been installed as beam steering aids in most parts of the SLC and are a part of the system that protects the SLC from damage by errant beams in several places. 5 refs., 3 figs., 1 tab.

31780 (SLAC-PUB–4965) **Momentum slits, collimators and masks in the SLC.** Walz, D.R.; McFarlane, A.; Lewandowski, E.; Zabdyr, J. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–144: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012266/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The high specific power densities in the SLC give rise to a multitude of challenging problems in collimation and momentum analysis, beam containment, machine protection and background control. The results of an extensive program to develop most of the devices deemed necessary for operation of the arcs matching sections and the final focus region are presented. Emphasis is placed on materials selection and on unique features of remotely adjustable slits and halo clipper collimators which have to operate with great precision in a high-radiation, ultra-high vacuum environment. Also covered are solutions for a few fixed aperture machine protection collimators. 7 refs., 5 figs.

31781 (SLAC-PUB–4967) **Beam dumps, stoppers and Faraday cups at the SLC.** Walz, D.R.; McFarlane, A.; Lewandowski, E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 2p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–151: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012264/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This presentation features most of the beam dumps and stoppers necessary to absorb and dissipate SLC $e^{\pm}$ beams with transverse sizes from several tens to a few hundred microns (μm). Solutions are based on electromagnetic cascade shower calculations for $N = 5 \times 10^{10}$ e/bunch and momenta ranging from 1.2 GeV/c in the damping ring transport systems to 50 GeV/c in the arcs matching sections and the Final Focus region. 3 refs., 2 figs.

31782 (UCRL–98803) **Simple models for electric gun operating characteristics.** Lee, R.S. Lawrence Livermore National Lab., CA (USA). Dec 1988. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890661–1: 3. international symposium on behavior of media under high dynamic pressures, La Grande Motte, France, 5-9 Jun 1989). Order Number DE89005348/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The electric gun, sometimes called a foil gun, uses the energy initially stored in a capacitor to electrically heat a thin conducting bridge in a transmission line connected to the capacitor. The deposited energy, typically several times the cohesive energy of the bridge material, is deposited in a time much less than the thermal time constant of the bridge, causing the bridge to explode violently. A thin dielectric layer (flyer plate) placed on top of the bridge can be accelerated to hypervelocity by the expansion of the bridge material and accompanying magnetic forces. The detailed physics of the heating and explosion process is very complicated. Elaborate computer codes are required for realistic models of the acceleration of the flyer plate, but a useful description of the gun performance can be obtained from the circuit characteristics and the properties of the bridge and flyer plate by simple empirical models. This paper will discuss simple models which have been successfully used to model electric gun performance. 6 refs., 5 figs., 1 tab.

31783 (UCRL–100910) **Magnetic switching.** Kirbie, H.C. Lawrence Livermore National Lab., CA (USA). 14 Apr 1989. 17p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8810135–3: Switched-power workshop, Shelter Island, New York, USA, 16-21 Oct 1988). Order Number DE89012299/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Magnetic switching is a pulse compression technique that uses a saturable inductor (reactor) to pass pulses of energy between two capacitors. A high degree of pulse compression can be achieved in a network when several of these simple, magnetically switched circuits are connected in series. Individual inductors are designed to saturate in cascade as a pulse moves along the network. The technique is particularly useful when a single-pulse network must be very reliable or when a multi-pulse network must operate at a high pulse repetition frequency (PRF). Today, magnetic switches trigger spark gaps, sharpen the risetimes of high energy pulses, power large lasers, and drive high PRF linear induction accelerators. This paper will describe the technique of magnetic pulse compression using simple networks and design equations. A brief review of modern magnetic materials and of their role in magnetic switch design will be presented. 12 refs., 8 figs.

31784 (UCRL–100911) **Switched power workshop: Power supply working group.** Haseroth, H.; Hopkins, D.; Ikezi, H.; Kirbie, H.C.; Lincke, E.; Wilson, M. Lawrence Livermore National Lab., CA (USA). 14 Apr 1989. 7p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. (CONF-8810135–4: Switched-power workshop, Shelter Island, New York, USA, 16-21 Oct 1988).

Order Number DE89012293/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The power supply working group was assigned the problem of pulse charging the 3-MeV gun. The gun is a radial line structure that has two charging configurations: a single ring charged to 500 kV or nine rings charged from 100 to 200 kV. In either configuration, the pulsed source must rapidly charge the structure's ring(s) before breakdown can begin. The issues encountered in charging the structure can be divided into two categories. First, the charging system must be well matched to the gun structure. Proper impedance matching will avoid reflections and limit the fault current if the ring should spark. Second, several systems can achieve the wide range of charge voltages necessary. Some are better suited to high voltages, while others are better at low voltages. The following paragraphs will address the impedance matching issues and review three choices for pulse generators. A system for each type of source is described along with a very rough cost estimate. 1 ref., 4 figs., 2 tabs.

4304 Storage Rings

Refer also to citation(s) 31695, 31718

31785 (CONF-890335–171) **Vacuum system development status for the APS [Advanced Photon Source] storage ring.** Wherle, R.; Nielson, R.; Kim, S. Argonne National Lab., IL (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, Illinois, USA; 20-23 Mar 1989. Order Number DE89013285/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The status of the design and fabrication of a prototype sector of the storage ring vacuum system for the Advanced Photon Source is described. The 26.5-m-long prototype sector will be assembled within a full-scale magnet and tunnel mockup to study interspacial component relationships for maintenance, as well as the vacuum system operational performance. Each completed vacuum section is mounted as an integral part of the modular structure that contains the magnets and magnet power supplies on a common base. Unique automatic machine welding designs and techniques are employed in the fabrication of the aluminium vacuum chambers from extrusions. Special chamber bending procedures and measurements checks are used to maintain the required flatness of the insider chamber light gap surfaces. Photo-electron yields due to low-energy photons in the narrow channel gap of the vacuum chamber and their potential effects on the overall outgassing rate are found to be negligible. 9 refs., 5 figs.

31786 (CONF-890560–1) **HISTRAP [Heavy Ion Storage Ring for Atomic Physics] prototype hardware studies.** Olsen, D.K.; Atkins, W.H.; Dowling, D.T.; Johnson, J.W.; Lord, R.S.; McConnell, J.W.; Milner, W.T.; Mosko, S.W.; Tatum, B.A. Oak Ridge National Lab., TN (USA). 1989. 6p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 12. international conference on cyclotrons and their applications; Berlin, Germany, F.R.; 8-12 May 1989. Order Number DE89013055/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

HISTRAP, Heavy Ion Storage Ring for Atomic Physics, is a proposed 2.67-Tm synchrotron/cooler/storage ring optimized for advanced atomic physics research which will be injected with ions from either the HHIRF 25-MV tandem accelerator or a dedicated ECR source and RFQ linac. Over the last two years, hardware prototypes have been developed for difficult and long lead-time components. A vacuum test stand, the rf cavity, and a prototype dipole magnet have been designed, constructed, and tested. 7 refs., 8 figs., 2 tabs.

31787 (IFVE-OUNK–88-15) **Status and development of Serpukhov tevatron.** Myznikov, K.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 19p. (In Russian). Order Number DE89617016/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Main characteristics and status of accelerating and storage 3 TeV complex created in the IHEP are presented. Two variants of colliding beams at the AES including proton-proton and antiproton-proton ones are considered. 11 construction sites for underground works are organized. From 26 vertical shafts 11 ones are completely ready. 7 km of tunnel are driven among which 1.25 km - in the injection channel. Construction of surface technological buildings has started. The ASC-1 serial equipment simulation is over. Preparation for serial production of equipment in the IHEP which will start in 1988 is conducted. Bench buildings for serial premounting testings and equipment accumulation will be put into operation in the middle of 1988. Serial production of SC-magnets is planned to be organized in the IHEP and production of their cryostates - in the Kriogenmash scientific and Industrial Association (SIA). A test to be produced in 1989 and serial production will begin in 1990. 12 refs.; 14 figs.; 3 tabs.

31788 (LA-UR–89-1575) **The proton storage ring: Problems and solutions.** Macek, R.J. Los Alamos National Lab., NM (USA). 1988. 34p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8810182–29: International collaboration on advanced neutron sources (ICANS), Los Alamos, New Mexico, USA, 3-7 Oct 1988). Order Number DE89012408/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Los Alamos Proton Storage Ring (PSR) now operates with 35μA at 20-Hz pulse repetition rate. Beam availability during 1988 suffered because of a number of problems with hardware reliability and from narrow operating margins for beam spill in the extraction line. A strong effort is underway to improve reliability with an eventual goal of obtaining beam availability in excess of 75%. Beam losses and the resulting component activation have limited operating currents to their present values. In detailed studies of the problem, loss rates were found to be approximately proportional to the circulating current and can be understood by a detailed accounting of emittance growth in the two-step injection process along with Coulomb scattering of the stored beam during multiple traversals of the injection foil. It is now apparent that the key to reducing losses is in reducing the number of foil traversals. A program of upgrades to reduce losses and improve the operating current is being planned. 8 refs., 17 figs., 2 tabs.

31789 (LUNTDX-NTMX–7008-1-12-1988) **Installation of a ferrite undulator in the MAX storage ring.** Werin, S. Lund Univ. (Sweden). Max-laboratory. 1988. 12p. Order Number DE89614319/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A permanent magnet undulator has been installed in the MAX storage ring. Some measurements according beam lifetime, change in operation point, linewidth and studies of asymmetries in the radiation distribution has been made.

31790 (NIKHEF-K-LINO–151) **Investigation into modulators. Progress report.** Heine, E. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie K. 15 Feb 1988. 22p. (In Dutch). Order Number DE89614320/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the framework of the MEA-update it is important to establish which modulators are necessary. In this report it is lookedif the existing modulators can be maintained or new modulators have to be made. Besides technical aspects also material expenses and necessary manpower play a role. 12 figs.; 6 tabs.

31791 (SLAC-PUB–4905) **Bunch lengthening calculations for the SLC [Stanford Linear Collider] damping rings.** Bane, K.L.F.; Ruth, R.D. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–161: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012278/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The problem of bunch lengthening in electron storage rings has been treated by many people, and there have been many experiments. In the typical experiment, the theory is used to determine the impedance of the ring. What has been lacking thus far, however, is a calculation of bunch lengthening that uses a carefully calculated ring impedance (or wakefield). In this paper we begin by finding the potential well distortion due to some very simple impedance models, in order to illustrate different types of bunch

lengthening behavior. We then give a prescription for extending potential well calculations into the turbulent regime once the threshold is known. Then finally, using the wakefield calculated for the SLC damping rings, combined with the measured value of the threshold, we calculate bunch lengthening for the damping rings, and compare the results with the measurements. 9 refs., 6 figs.

31792 (SLAC-PUB–4906) **Timing and rf synchronization for filling PEP/SPEAR with the SLC Damping Rings.** Ronan, M.T.; Lambert, D.J.; Lee, K.L.; Bernstein, D.R.; Corredoura, P.; Jobe, R.K.; Ross, M.C.; Roster, B.; Vancraeynest, J.; Zapalac, G. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (LBL–26809;CONF-890335–162: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012277/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An innovative timing and rf synchronization system has been built and commissioned which allows the direct injection of 1 mm σ_z e^+ or e^- bunches from the SLC Damping Rings (ν_{rf} = 714 MHz) into the storage rings PEP (ν_{rf} = 353 MHz) and SPEAR (ν_{rf} = 358 MHz). The required relative stability of these oscillators is 10^{-9} since the beams may be stored in each damping ring (DR) for up to 0.2 sec., during which no timing correction is made, and must be delivered within a 0.5 nsec window. This stability has been obtained by phase-locking the storage ring rf to the LINAC-DR master oscillator. In order to obtain bunched beams for acceleration in the LINAC 10.5 cm rf structure while maintaining the storage ring timing requirements, the Subharmonic Buncher and Damping Ring rf are phase-shifted using GaAs digital circuitry. This paper describes the phase-locked loops, the rf distribution system, the S-band resettable dividers and the interpulse timing system components used in this project. 4 refs., 4 figs., 1 tab.

31793 (SLAC-PUB–4913) **A formalism and computer program for coupled lattices.** Raubenheimer, T.O. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–163: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012276/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper, a formalism to calculate the lattice functions and emittances of a coupled electron/positron storage ring is presented. The lattice functions are calculated directly from the modal matrix of the betatron transport matrix for the ring. The emittances and damping rates are then calculated from the invariants found in the diagonalized representation. In addition, a computer program is described which uses the formalism to calculate the coupled lattice functions, emittances and damping rates. The program can either reconstruct the closed orbit from BPM data and dipole corrector strengths, or construct an orbit from misalignments entered into the the lattice and then optionally correct the orbit with dipole correctors. The lattice functions, emittances, etc. are then calculated about the resulting closed orbit. 7 refs.

31794 (SLAC-PUB–4914) **Analytic estimates of coupling in damping rings.** Raubenheimer, T.O.; Ruth, R.D. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890335–164: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012275/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper we present analytic formulas to estimate the vertical emittance in weakly coupled electron/positron storage rings. We consider contributions from both the vertical dispersion and linear coupling of the betatron motions. In addition to simple expressions for random misalignments and rotations of the magnets, formulas are presented to calculate the vertical emittance blowup due to orbit distortions. The orbit distortions are assumed to be caused by random misalignments, but because the closed orbit is correlated from point to point, the effects must be treated differently. We consider only corrected orbits. Finally, the analytic expressions are compared with computer simulations of storage rings with random misalignments. 6 refs., 3 figs.

44 INSTRUMENTATION

4401 Radiation Instrumentation

Refer also to citation(s) 30437, 30638, 31668, 31695, 32009, 32462, 32474, 32493, 32494, 32496, 32498, 32500, 32501, 32648, 32746, 32772, 32777, 32782, 32872, 32956

31795 (ACIESP–60(v.3), pp. 84-90) **Ballon-Borne experiments to study hard x-rays and gamma-rays from SN 1987 A.** Kamae, T. (Tokyo Univ. (Japan). Dept. of Physics); Takahashi, T.; Gunji, S. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

Two balloon-borne experiments to detect gamma-rays and hard X-rays from SN1987A are in preparation. The gamma-ray detector is made of CsI(Tl) scintillation counters and sensitive to energy range of 0.3 MeV to 300 MeV. The detection part is made of 16 small crystals (3.7x3.7x10.0cm/sup 3/) each viewed by a newly-developed large area photodiodes (1.8x1.8cm/sup 2/). The detection part is surrounded by thick active shield and collimators made of CsI(Tl). A detector for hard X-rays is composed of 36 phoswich arrangements of CsI(Tl) and pure CsI. The detector has a sensitivity between 30 KeV and 300 KeV. Both detectors have a time resolution of 0.1 ms and are capable of detecting a pulsar period of 1 ms.

31796 (ACIESP–60(v.3), pp. 129) **Performance of the 13.7 m Itapetinga radiotelescope.** Abraham, Z. (Sao Paulo Univ., SP (Brazil). Inst. Astronomico e Geofisico). Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

RADIO TELESCOPES/performance; PERFORMANCE

31797 (ACIESP–60(v.3), pp. 179-183) **Coded mask telescope for observations of X and gamma ray sources in the Southern sky.** Villela, T. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Jayanthi, U.B.; Neri, J.A.C.F.; Braga, J.; Souza, C.A.W.; Figueiredo Filho, N. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

An x and gamma-ray telescope employing coded aperture imaging technique to observe southern sky sources in the energy range of 40 KeV to 8 MeV with an angular resolution of $\sim$ 20 arc min is described. The payload to be flown at 40 Km altitude on board a stratospheric balloon will utilize a stabilized platform. The technical and scientific aspects of the experiment, are discussed.

31798 (ACIESP–60(v.3), pp. 184) **Measurements of low energy gamma radiation balloon experiment for supernova 1987A.** Jayanthi, U.B.; Villela, T.; Neri, J.A.C.F.; Souza, C.A.W.; Figueiredo Filho, N. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

GAMMA DETECTION/balloons; GAMMA DETECTION/supernovae; BALLOONS; SUPERNOVAE; KEV RANGE 100-1000; NAI DETECTORS

31799 (ACIESP–60(v.3), pp. 271-279) **Rocket-borne Langmuir probe response to an applied periodic potential.** Muralikrishna, P. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Abdu, M.A.; Kantor, I.J. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–:

6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

A Langmuir Probe (LP) payload designed and developed at Instituto de Pesquisas Espaciais (INPE/MCT) was flown on-board a SONDA III rocket at 2259 hrs. (LST) on October 31, 1986 from the Centro de Lancamento da Barreira do Inferno in Natal, RN, Brazil, under a collaborative programme between INPE and Instituto de Atividades Espaciais (IAE/CTA). A sweep voltage varying between -IV and +4V in a period of about 2.6 seconds was applied to the LP sensor. As the applied voltage increased from -IV to +4V, the LP sensor current first showed an increase, reached a saturation level, and then, though the sensor potential increased towards a steady value, the current showed a systematic decrease. This sensor current characteristic also showed a clear dependence on altitude and hence on the ambient plasma parameters. Possible physical mechanisms responsible for these LP response characteristics are analysed and discussed here.

31800 (ANL-HEP-CP–89-12) **Development of Radhard VLSI electronics for SSC calorimeters.** Dawson, J.W.; Nodulman, L.J. Argonne National Lab., IL (USA). 1989. 14p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-890270–14: International industrial symposium on the super collider, New Orleans, Louisiana, USA, 8-10 Feb 1989). Order Number DE89013653/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A new program of development of integrated electronics for liquid argon calorimeters in the SSC detector environment is being started at Argonne National Laboratory. Scientists from Brookhaven National Laboratory and Vanderbilt University together with an industrial participants are expected to collaborate in this work. Interaction rates, segmentation, and the radiation environment dictate that front-end electronics of SSC calorimeters must be implemented in the form of highly integrated, radhard, analog, low noise, VLSI custom monolithic devices. Important considerations are power dissipation, choice of functions integrated on the front-end chips, and cabling requirements. An extensive level of expertise in radhard electronics exists within the industrial community, and a primary objective of this work is to bring that expertise to bear on the problems of SSC detector design. Radiation hardness measurements and requirements as well as calorimeter design will be primarily the responsibility of Argonne scientists and our Brookhaven and Vanderbilt colleagues. Radhard VLSI design and fabrication will be primarily the industrial participant's responsibility. The rapid-cycling synchrotron at Argonne will be used for radiation damage studies involving response to neutrons and charged particles, while damage from gammas will be investigated at Brookhaven. 10 refs., 6 figs., 2 tabs.

31801 (ANL-HEP-CP–89-33) **The Soudan 2 proton decay experiment.** Thron, J.L. Argonne, Minnesota, Oxford, Rutherford, Tufts colaboration. Argonne National Lab., IL (USA). 1989. 14p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-890231–6: 5. international wire chamber conference, Vienna, Austria, 13-17 Feb 1989). Order Number DE89013276/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Soudan 2 proton decay experiment is now 1/4 complete and assembled at the bottom of the Soudan iron mine in northern Minnesota, USA. When completed, it will be an 100 ton, fine grained, iron calorimeter. It is comprised of 256 identical modules. The cavity is 14 x 72 x 11 x m (w x 1 x h) large enough to accommodate a 3300 ton detector of similar design. The detector samples track positions every 15, 10, and 2mm along the three spatial coordinations. Thus, the detector will have excellent tracking capabilities for the low energy charged particles and electromagnetic showers expected from nucleon decay candidates and neutrino background events. In addition, for such events the energy of particles observed is sufficiently low that they will stop inside the detector. The measurement of the ionization deposited as a function of track length allows the determination of track and will yield some information on the particle type. In addition to the dE/dx measurements the Soudan 2 detector has several advantages over previous nucleon decay detectors. The honeycomb geometry has very isotropic detection compared with other tracking detectors. The thin steel and local triggering system produces a low trigger threshold giving excellent efficiency for multiparticle decay nodes or ones with missing energy due to neutrinos. 8 figs.

31802 (ANU-P–978) **Identification and rejection of energy-degraded events in gas ionization counters.** Ophel, T.R.; Fifield, L.K.; Catford, W.N.; Orr, N.A.; Woods, C.L.; Harding, A.; Clarkson, G.P. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. May 1988. 56p. Order Number DE89617333/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

A common feature of the measurement of charged particles with gas detectors is the presence of a small fraction of events (~0.1-0.2%) for which significantly less than total ionization is recorded. These events cause an energy tailing that can seriously impair the identification functions of gas detectors used either to instrument the focal plane of magnetic spectrometers or for accelerator mass spectrometry. The anomalous, energy-degraded events are shown to arise both from reactions between the incident ions and the detector gas and, more importantly from the scattering of ions by the gas. It is demonstrated that an appropriate detector configuration provides the means to reject most of the anomalous events, allowing the measurement of very low cross-section reactions without significant background interference from such events.

31803 (BNL–42683) **MWPC with highly segmented cathode pad readout.** Debbe, R.; Fischer, J.; Lissauer, D.; Ludlam, T.; Makowiecki, D.; Radeka, V.; Rescia, S.; Smith, G.C.; Stephani, D.; Yu, B. Brookhaven National Lab., Upton, NY (USA). 1989. 18p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890231–7: 5. international wire chamber conference, Vienna, Austria, 13-17 Feb 1989). Order Number DE89012672/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Experiments being conducted with high energy heavy ion beams at Brookhaven National Laboratory and at CERN have shown the importance of developing position sensitive detectors capable of handling events with high multiplicity in environments of high track density as will also be the case in future high luminosity colliders like SSC and RHIC. In addition, these detectors are required to have a dynamic range wide enough to detect minimum ionizing particles and heavy ions like oxygen or silicon. We present here a description of work being done on a prototype of such a detector at BNL. Results from a similar counter are also presented in this Conference. The "pad chamber" is a detector with a cathode area subdivided into a very large number of pixel-like elements such that a charged particle traversing the detector at normal incidence leaves an induced charge on a few localized pads. The pads are interconnected by a resistive strip, and readout amplifiers are connected to the resistive strip at appropriate, carefully determined spacings. The pattern of tracks in a multi-hit event is easily recognized, and a centroid-finding readout system allows position determination to a small fraction of the basic cell size. 5 refs., 9 figs.

31804 (BNL–42688) **MPS [Multiparticle Spectrometer] data acquisition software system.** Saulys, A.C.; Etkin, A.; Foley, K.J.; Hackenburg, R.W.; Longacre, R.S.; Love, W.A.; Morris, T.W.; Platner, E.D.; Lindenbaum, S.J.; Chan, C.S. Brookhaven National Lab., Upton, NY (USA). 4 Apr 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890415–2: Computing in high energy physics, Oxford, UK, 10-14 Apr 1989). Order Number DE89012673/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A description of the software for a FASTBUS based data acquisition system in use at the Brookhaven National Laboratory Multiparticle Spectrometer is presented. Data reading and formatting is done by the SLAC Scanner Processors (SSP's) resident in the FASTBUS system. A multiprocess software system on VAX computers is used to communicate with the SSP's, record the data, and monitor on-line the progress of high energy and heavy ion experiments. The structure and the performance of this system are discussed. 4 refs., 1 fig.

31805 (CNIC–00130) **Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent**

extraction-liquid scintillation count method. Zhou Shunli; Zheng Hualing; Chen Shuming; Wang Shouzhong; Jiao Rongzhou; Fan Shiguo; Liu Bingren. China Nuclear Information Centre, Beijing, BJ (China). 1988. 6p. (In Chinese). (BINE–0005). Order Number DE89614619/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The solvent extraction-liquid scintillation count method has been studied, TRPO has been used as the extractant, dimethylbenzol as the diluent, 2,5-diphenyloxazole as the scintillator. The quenching effects caused by TRPO or other impurity elements have been studied. The results appear that this method can determine trace α-nuclide contents (/sup 233/U, /sup 239/Pu, /sup 241/Am) with a large quantity of impurity elements and amino-polycarboxylic acid. The determination can be done simply, quickly and sensitively.

31806 (CNIC–00171) **On-line monitor for cation exchange elution chromatography using lithium silicate glass beads as solid scintillator.** Zhu Rongbao; Yang Liucheng; Wei Liansheng; Ji Liqiang; Zhang Zengrui. China Nuclear Information Centre, Beijing, BJ (China). Mar 1988. 12p. (In Chinese). (IAE–0043). Order Number DE89617353/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A new type of on-line monitoring system used to monitor radioactive nuclides with α or soft β radiation in the effluent from a high pressure ion exchange column is described. The beads made of cerium-impregnated lithium silicate glass are used as scientillation material. They are filled into a quartz glass tube to form a flow cell. By reducing the diameter of glass beads to more closly approximate the average range of α or soft β radiation in solution, the absolute counting efficiency for /sup 241/Am, /sup 242/Cm α radiation have reached and 85.8% and 92.8% respectively, for /sup 14/C, /sup 90/Sr-/sup 90/Y β radiation, 62.1% and 88.6% respectively. These values can be comparable to those achieved with on-line liquid scientillation technique. When the total amount of /sup 241/Am added into column is decreased to 7.4 Bq it is still possible to obtain a clear chromatography peak (half peak width = 0.22 mL).

31807 (CONF-890379–3) **Detectors for the Superconducting Super Collider, design concepts, and simulation.** Gabriel, T.A. Oak Ridge National Lab., TN (USA). 1989. 35p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Workshop on calorimetry for the SSC; Tuscaloosa, Alabama, USA; 13-17 Mar 1989. Order Number DE89013041/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The physics of compensation calorimetry is reviewed in the light of the need of the Superconducting Super Collider (SSC) detectors. The four major detector types: liquid argon, scintillator, room temperature liquids, and silicon, are analyzed with respect to some of their strengths and weaknesses. Finally, general comments are presented which reflect the reliability of simulation code systems. 29 refs., 20 figs., 6 tabs.

31808 (CONF-890379–4) **CALOR89: The code system for calorimeter analysis and design.** Gabriel, T.A. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From Workshop on calorimetry for the SSC; Tuscaloosa, Alabama, USA; 13-17 Mar 1989. Order Number DE89013042/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

As part of a strong experimental high energy physics program, a substantial effort must be involved in calculational analysis of the detector system. The calculational capability must be fundamentally sound and based on previous interchange between theoretical calculations and experimental test programs. The CALOR89 system for analyzing calorimeters offers a solid approach for investigating all facets of detector systems and has been used in many calculational studies. CALOR89 is one of two major code systems recommended for analysis of SSC detector systems. 15 refs., 1 fig.

31809 (CRN-HE–86-09) **Design and develpment of photoelectron detection chambers for the DELPHI experiment RICH Cerenkov counters.** Amrane, N. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). 1986. 149p. (In French). Order Number DE89776428/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

The particle identifier of the Barrel-RICH detector, based on the Cerenkov effect is a crucial element of the DELPHI spectrometer. In this detector, Cerenkov light is focussed as a ring whose diameter is related to the velocity of the particle. The measure of the ring's diameter is done by conversion of photons in a gaseous environment and then by measure of the position of the photons in a wire chamber after the drift of the photoelectrons. Three types of wire chambers (chambers in U shape, circular chambers, chambers with flat cathodes) have been designed and tested. The choice of the flat cathode chambers has been determined by the reliability, the simplicity and the considerations of price.

31810 (DOE/ER/40372–02) **Scintillating fiber detector development for the SSC: Annual progress report.** Ruchti, R.C. Notre Dame Univ., IN (USA). 29 May 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC02-87ER40372. Order Number DE89013118/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the past year, considerable effort has been applied to the development of scintillating fiber detectors in several areas: new scintillation liquids and studies of their fluorescence properties; new fluorescent dyes based on non-intramolecular proton transfer; new dyes based on intramolecular proton transfer; incorporation of these new dyes in plastic (polystyrene) and liquid scintillation solutions; development of small cross section glass capillaries for the containment of liquid scintillators; studies of waveguide characteristics; studies of image intensifier phosphor screen characteristics; initial steps to form a collaboration to study and develop appropriate new properties of the Solid State Photomultiplier; construction of a new laboratory at Notre Dame to enhance our capabilities for further measurements and studies; and organization of and execution of a Workshop on Scintillating Fiber Detector Development for the SSC, held at Fermilab, November 14–16, 1988.

31811 (FNAL/C–89/109) **Hermeticity of three cryogenic calorimeter geometries.** Strovink, M.; Wormersley, W.J.; Forden, G.E. Fermi National Accelerator Lab., Batavia, IL (USA). Apr 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890379–5: Workshop on calorimetry for the SSC, Tuscaloosa, Alabama, USA, 13-17 Mar 1989). Order Number DE89013086/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We calculate the effect of cracks and dead material on resolution in three simplified cryogenic calorimeter geometries, using a crude approximation that neglects transverse shower spreading and considers only a small set of incident angles. For each dead region, we estimate the average unseen energy using a shower parametrization, and relate it to resolution broadening using a simple approximation that agrees with experimental data. Making reasonable and consistent assumptions on cryostat wall thicknesses, we find that the effects of cracks and dead material dominate the expected resolution in the region where separate "barrel" and "end" cryostats meet. This is particularly true for one geometry in which the end calorimeter caps the barrel and also protrudes into the hole within it. We also find that carefully designed auxiliary "crack filler" detectors can substantially reduce the loss of resolution in these areas. 6 figs.

31812 (ILL–9013157) **Notes on the theory of parallel plate avalanche detectors.** Arruda-Neto, J.D.T. Illinois Univ., Urbana, IL (USA). Nuclear Physics Lab. Jan 1986. 33p. Order Number DE89013157/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

A simple theory that explains the main characteristics of a parallel plate avalanche detector is presented. A few examples for illustration purposes are worked out. 12 refs., 10 figs.

31813 (INFN-LNF–88-45(P)) **Tracking techniques in underground physics.** Battistoni, G. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1988. 10p. (CONF-8806235–: International conference on advanced technology and particle physics, Como, Italy, 12-17 Jun 1988). Order Number DE89614587/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Tracking of penetrating particles in underground experiments is discussed. The application to this field of the streamer tube technology is reviewed, with a particular reference to the MACRO experiment at Gran Sasso and its collaboration with industry. Other

tracking technologies for large area detectors are presented. 40 refs.

31814 (INIS-BR–1458, pp. 223) **Gamma ray attenuation as a method to determine the water infiltration and redistribution parameters in soil.** Oliveira, J.C.M. de (Universidade Estadual de Londrina, SC (Brazil)); Souza, A.D.B. de; Appoloni, C.R.; Santos, C.A.C.; Costa, A.C.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

HYDRAULIC CONDUCTIVITY/measuring methods; SOILS/hydraulic conductivity; SOILS/water influx; WATER INFLUX/measuring methods; AMERICIUM 241; ATTENUATION; COBALT 60; GAMMA RADIATION; GAMMA SOURCES; MATHEMATICAL MODELS; NAI DETECTORS; SOILS; RADIATION ABSORPTION ANALYSIS

31815 (INIS-mf–11357, pp. 328-339) **Development of nuclear suspended sediment flux gauge HDD-1.** Liu Yuren (Yellow River Conservancy Commission (China). Inst. of Hydraulic Research); Lu Yanxin; Wei Weimin; Xie Yali; Wang Yonghai. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The Nuclear Suspended Sediment Flux Gauge (NSSFG) is a new-type meter for complete sectional suspended sediment flux fast measurement which is based on measurement of various hydrologic parameters, such as sediment concentration, water depth, velocity of flow and distance from the starting point and so on with data processing in-situ using microcomputer. It has been tested during flood season of the Yellow River and has been compared with routine sectional integration method. The comparison square-root deviation is ±4.7% which can meet the demands of the state hydrologic norm. (author). 3 refs, 9 figs, 1 tab.

31816 (Juel–2222) **Detector system for two-dimensional, position-sensitive detection of neutrons and gamma quanta.** Scholz, A. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentrallabor fuer Elektronik; Technische Hochschule Aachen (Germany, F.R.). Aug 1988. 122p. (In German). Order Number DE89774818/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

While the well-known Anger Camera utilizes a large number of photomultiplier tubes, which are arranged in a regular array behind a scintillation crystal, the new detector system makes use of electron optics to transfer the scintillation image of a large scintillation crystal (Li-6-glass) onto a small position detector. Because of this, only few photodetectors are required for position readout, associated with only a small number of amplifier chains and a very simple position reconstruction algorithm. The reduced complexity of the readout electronics ultimately leads to an improved maintainability and reliability of the detector system. A prototype of the new detector system was built and tested. After giving an overview on already known and realized detector configurations, the basic considerations, which led to the final detector design, will be explained. Different methods of detector readout and position determination are discussed. Measurement results which were obtained with the prototype detector system are presented and explained by means of simulation calculations.

31817 (Juel-Spez–480) **Fast trigger scintillator for the JETSET experiment (PS202/LEAR).** Sefzick, T. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik. Dec 1988. 123p. (In German). Order Number DE89774680/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

In the present thesis the trigger detector of the JETSET experiment (PS202) at the LEAR/CERN consisting of scintillation counters is presented. After giving a start signal in a second stage of the trigger electronics the determination of the position of the traversed points of the reaction products is performed with the information of the scintillation detector. A third following trigger stage shall study the position informations given by the second stage under kinematical points of view. The present diploma thesis deals especially with the first two trigger stages. As basic conditions the components of a scintillation counter are treated and calibration and testing possibilities presented. For this belongs a fast light pulser with green or blue LED. Results of the studies which scintillator and light-guide materials are most suitable for the JETSET experiment are presented. (orig./HSI).

31818 (KIYI–88-8) **Low-background setup for the investigation of rare processes of nuclear decay.** Vasilenko, V.V.; Danevich, F.A.; Zhuk, N.A. and others. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 24p. (In Russian). Order Number DE89617338/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The low-background setup is constructed for the investigation of rare processes of nuclear decay and low-level radioactivity measurements. The installation is located in the undeground laboratory of the Institute for Nuclear Research, the Ukrainian Academy of Sciences, at the depth of 430 m in a salt mine. The preliminary measurements of the NaI (Tl) detector background were made. The setup enables to measure the radioactive contamination of materials for low-background instrumentations at specific activity up to 10/sup -15/Cu/g and to make the search of double beta decay and other rare processes at competing-capable level. 13 refs.; 8 figs.; 1 tab.

31819 (KIYI–88-29) **On-line measurement system of multidimensional spectra with real time digital preprocessing of experimental information.** Berezin, F.N.; Kisurin, V.A.; Levon, A.I. and others. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 17p. (In Russian). Order Number DE89617335/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The on-line system for multidimensional spectra measurement at experiments in the field of low energy nuclear physics has been developed. Hardware technique of selection and classification of incoming events on predetermined criteria and acquisition of corresponding spectra in buffer memory is used. The system has been used for investigations of electromagnetic properties of excited states of nuclear at the U-120 cyclotron of the Institute for Nuclear Research, the Ukr. Academy of Sciences. 7 figs.

31820 (KIYI–88-30) **Rastr-RT interactive graphics system for real time tasks.** Kumshaev, S.B.; Gaevenko, A.Yu.; Maznyj, I.A.; Ofengenden, R.G. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 11p. (In Russian). Order Number DE89617336/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The interactive graphics system RASTR-RT for real-time applications developed in accordance with interntional standard GKS is described. System functions and their employment for vizualization of spectrometrical and service information are considered. 5 refs.

31821 (KIYI–88-33) **Precision impulse generator for stabilization of a semiconductor spectrometer.** Zhuk, N.A.; Zdesenko, Yu.G.; Kuts, V.N. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 13p. (In Russian). Order Number DE89617349/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The stable amplitude impulse generator is worked out consisting of a constant voltage source, a storage element and a key based on mercury relay. The thermostating source provides the voltage unstability to 12x10/sup -6//degrees and less than ±5x10/sup -6/ during 80 hours. The mercury relay is placed in a separate thermostat. The unstability of generator output pulses is equal to 1x10/sup -5//degrees and less than ±1,5x10/sup -5/during 24 hours. 8 refs.; 3 figs.; 1 tab.

31822 (KIYI–88-40) **Position-sensitive detector for local plane of the beta-spectrometer.** Gavrilyuk, V.I.; Zheltonozhskij, V.A.; Korsak, V.Ya. and others. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 35p. (In Russian). Order Number DE89617337/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The position-sensitive detector for focal plane of high resolution magnetic beta spectrometer of the Institute for Nuclear Research of the Ukrainian SSR Academy of Sciences is described. The construction and adjustment mechanism of the position-sensitive detector were developed for specific operation conditions. The first results of precision measurements of nuclear decay of /sup 181/Ta and /sup 180m/Hf by means of multichannel position-sensitive detector is presented. 35 refs.; 12 figs.; 2 tabs.

31823 (LA–11596-MS) **Wire chamber assembly techniques: More methods.** MacArthur, D.W.; Allander, K.S.; Matthews, S.K. Los Alamos National Lab., NM (USA). Jun 1989. 19p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89011846/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report is intended as an extension if "Wire Chamber Assembly Techniques," published as Los Alamos National Laboratory report LA-11237-MS. We describe a series of chamber assembly techniques that were developed after the procedures discussed in our first report. Although many of these techniques were developed using a set of wire chambers that were designed and built by the Advanced Nuclear Technology Group, many of our methods are of more general interest and can be applied to a variety of chamber designs. 9 refs., 14 figs.

31824 (LA–11612-MS) **An imaging detector for neutron or gamma sources.** Byrd, R.C.; Gavron, A.; Leitch, M.J.; McGaughey, P.L.; Sailor, W.C.; Sunier, J.W.; Yariv, Y. Los Alamos National Lab., NM (USA). Jun 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89012606/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A detector with the ability to determine both the angle of incidence and the energy of neutrons or gammas is described. It has moderate spatial resolution, good timing resolution, large acceptance, and reasonable detection efficiency. The detector may be operated either with a neutron or gamma generator or in a stand-alone mode with a radioactive source. Such an instrument could be used in various scientific and nondestructive testing applications to provide fast-neutron spectroscopy or three-dimensional imaging capability. This report includes a description of the detector, the equations used to calculate the energy and angle of an incident neutron from the measured observables, and Monte Carlo calculations of the resolution and detection. 3 refs., 9 figs.

31825 (LBL–27063) **A large superconducting detector magnet without an iron return path.** Green, M.A. Lawrence Berkeley Lab., CA (USA). Feb 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890270–18: International industrial symposium on the super collider, New Orleans, Louisiana, USA, 8-10 Feb 1989). Order Number DE89013190/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes a detector magnet which returns flux between the coils rather than through an iron return path. This actively shielded, uniform field 2 T magnet can be fabricated in separate parts which can be manufactured on the SSC site. This magnet can be built so that central field is uniform enough to permit a TPC detector to be used without iron poles. The field outside of the coil can be made to fall of as R^{-N} power where N approaches 9. A major advantage of the magnet described in the paper is that there is no pole piece to block the particle jets emanating from the collision region in the forward and backward directions. Inexpensive materials such as earth and concrete can be used to provide the mass needed to analyze particles such as mu mesons. As a result, problems such as experimental hall subsidence can be reduced. Perhaps the cost of such an experiment can also be reduced. This type of magnet would require experimenters to rethink their experimental concepts. 8 refs., 5 figs., 2 tabs.

31826 (OEVS-Mitteilung–1988, pp. 177-181) **Measurement techniques for the estimation of the Rn-222 concentration and the exhalation rate indoors and outdoors using an activated carbon bed.** Pensko, J. (Polish Medical Physics Society, Warszawa (Poland)); Wicke, A. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A novel charcoal radon dosimeter is described. Rn-222 from air is absorbed on charcoal grains. The activity of radon daughters - Bi 214 - is determined by gamma spectroscopy. Formulae are given for calculating Rn-222 concentrations and exhalation rates from walls, ground or soil. 5 refs., 5 figs., 1 tab. (qui).

31827 (OEVS-Mitteilung–1988, pp. 470-479) **Radiation protection instruments and methods - today and tommorrow.** Maushart, R. (Laboratorium Prof. Dr. Berthold, Wildbad (Germany, F.R.)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A glance on the history of development of radiation protection instruments teaches that their technical progress is influenced and advanced by several force fields which may be effective individually or together. There is the incentive, if not the compulsion 'from outside' by lawful rules and regulations; there is the impulse 'from inside', that means the efforts of the manufacturer to comply with the requirements of the market, or to rationalize production; and finally, there are the new technologies urging to be exploited. For all three development motivations, typical instruments are presented. Radiation protection measuring instruments of today differ from yesterdays' most strikingly by the much more flexible and expedient display of the values. With stationary systems, the video screen is almost standard today; with the portable instruments, the change to displays with writing and at least semigraphical presentations is in full swing. All this is backed-up, evidently, by a lot of microelectronics. 2 refs.

31828 (OEVS-Mitteilung–1988, pp. 493-500) **Practical experience with dose measurements in uranium mines.** Schmitz, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit); Urban, M.; Pineau, J.F.; Zettwoog, P. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The aim was the development of dosimetry methods for lung exposure of uranium mine workers. Three independent methods, a working-place commercial instant working level meter, and the CEA and KFK personnel dosimeters were compared. Only the two integrating personnel dosimeters, the active CEA dosimeter and the passive KFK dosimeters, have a significant correlation of their results. Different working conditions were adopted, e.g. of low and high ventilation. The IWLM-measurements could not be correlated with the dosimeters but are nevertheless indispensable to account for rapid changes of the working conditions at site. 10 refs., 5 figs. (qui).

31829 (OEVS-Mitteilung–1988, pp. 514-518) **International intercomparison of environmental gamma dose-rate meters.** Lauterbach, U. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)); Pessara, W. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The readings of gamma dose-rate meters based on various detector systems were compared in natural and artificial radiation fields of different quality. The response to extremely low dose rates,

to the cosmic and terrestrial radiation and the energy dependence of the response were investigated. 4 refs., 2 figs.

31830 (OEVS-Mitteilung–1988, pp. 519-522) **Sensitivity measurements of an environmental GM-monitor for Ra-226 series placed on the ground surface.** Nagy, G. (Central Research Institute for Physics, Budapest (Hungary)); Feher, I. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The changes of the external gamma field are continuously monitored by GM detectors in the vicinity of the Paks nuclear power station. The chamber of the monitoring station shields the gamma radiation of the natural fallout. This shielding effect has been investigated by Ra-226 point-like sources placed on the ground surface. The walls of the chamber caused observable changes in the angular dependences of the sensitivity. 6 refs., 3 figs.

31831 (OEVS-Mitteilung–1988, pp. 523-526) **Experience with a continuously operating water sampling system.** Buchtela, K. (Atominstitut der Oesterreichischen Universitaeten, Vienna (Austria)); Tschurlovits, M. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Grab sampling, as used usually for taking water samples, has clear practical advantages, but is not sufficient from the conceptual point of view when changes in the activity concentration have to be expected in the sampling interval. The paper is concerned with experience gathered with some continuous water sampling systems which are operated for some time in the Danube river. Both practical and conceptual aspects of the continuous technique are discussed. The discussion includes problems of setting in operation of the equipments as well as operational difficulties. Eventually, the results obtained with the continuous sampling system are compared with those from grab sampling. 1 ref., 1 fig.

31832 (OEVS-Mitteilung–1988, pp. 527-530) **Measurements and calculations on the responses of a NaI(Tl) detector immersed in a water tank containing different radioisotopes.** Nagy, G. (Central Research Institute for Physics, Budapest (Hungary)); Koblinger, L. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Gamma activity to count rate conversion factors in a large volume water tank were measured by Tc-99m, Na-24 and Cu-64 isotopes diluted in the water and calculated by a Monte Carlo code. 4 refs., 3 figs., 1 tab.

31833 (OEVS-Mitteilung–1988, pp. 544-548) **Central registration system for on line monitoring of radioactivity concentrations and radiation levels.** Vries, W. de (Interuniversitair Reactor Inst., Delft (Netherlands)); Kooij, A. van der; Bos, A.J.J.; Passchier, W.F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A central registration system for monitoring radioactivity concentrations and radiation levels is described. The system consists of twenty detectors placed in and around the reactor institute. Twelve detectors measure activity concentrations in air and water, six detectors measure radiation levels and two detectors measure wind direction and wind velocity. Signals from the detectors are collected by a central 8080 microprocessor, which in turn feeds a LSI 11/2 computer for data processing and data storage. Count rates of all detectors are shown in a bar chart on a video display. A count rate in excess of a preset level causes an audible and visual alarm. Calibration factors for all 20 detectors were determined experimentally. 2 refs., 1 fig., 2 tabs.

31834 (OEVS-Mitteilung–1988, pp. 549-553) **Fluctuations and accuracy of a digital exposure ratemeter.** Koturovic, A.M. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)); Vukanovic, R.B. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Fluctuations and accuracy are analysed for digital ratemeters when the floating mean value algorithms are applied. The statistical nature of signal pulse train is taken into account, and relevant relations are derived. 5 refs., 3 figs.

31835 (OEVS-Mitteilung–1988, pp. 563-567) **Calculated dose equivalent responses of albedo and track etch individual neutron dosemeters on the ICRU-phantom.** Siebert, B.R.L. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)); Hollnagel, R.; Jahr, R. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The dose equivalent responses of individual neutron dosemeters are calculated by means of the Monte Carlo method. The effects of different neutron energies (thermal to 14 MeV), different directional distributions of incident neutrons and different distances between dosemeter and phantom are studied. 11 refs., 3 figs.

31836 (OEVS-Mitteilung–1988, pp. 568-572) **Calibration of thermoluminescence dosemeters for personnel dosimetry.** Mini, R. (Inselspital, Abt. fuer medizinische Strahlenphysik, Bern (Switzerland)); Jenzer, U. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

With modern TL personnel dosimetry systems, dosemeter evaluation can be done quickly and reliably. The measured data are used as a starting point for calculation of the so-called whole-body doses. There the energy dependence of the response must be considered. This can be determined by a suitable calibration. The calibration methods used differ considerably with regard to expenditure and accuracy. Here a calibration procedure meeting the present-day's conditions is described. 2 figs.

31837 (OEVS-Mitteilung–1988, pp. 573-577) **Long-term sensitivity with an automatic TL personnel dosimetry system.** Mini, R. (Inselspital, Abt. fuer medizinische Strahlenphysik, Bern (Switzerland)); Jenzer, U. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Since the response of thermoluminescent dosimeters are highly affected by systemdependent parameters, any variation in the reader conditions, in the thermal treatment or in the readout parameters may cause significant changes of the relative sensitivity of the system. For this reason the essential parameters determining satisfactory operation of the dosimetry system must be regularly monitored. For most commercially available systems a certain number of controls, like the control of the preheating and heating temperatures or the control of the power supply voltage of the photomultiplier, are carried out automatically. In the daily routine work of a personnel monitoring laboratory these controls have to be complemented by specific measurements which check the general behaviour of the measurement circuit and which make part of the dose evaluation procedure. The analysis of these measurements over a long period permit an estimation of the practical long-term stability of the sensitivity of an automatic radiothermoluminescent dosimetry system. The authors report on the experience gained in the field with the use of a standard Harshaw system of a Swiss personnel monitoring laboratory. 1 ref., 2 figs.

31838 (OEVS-Mitteilung–1988, pp. 578-582) **Phosphate glass dosimetry - after 25 years of routine use: new perspectives for personnel- and environment monitoring.** Piesch, E. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

25 years of development and routine use of dosimetry PLD systems are outlined. With the new Toshiba readout apparatus FGD-8 an energy-independent readout of H'(10) in the photon energy range of 15 keV-1,2 meV and accuracy of ±13% is possible, due to UV-laser excitation, now without glass washing. Thus the UV-laser excitation in conjunction with automatic evaluation opens new application options in radiation dosimetry. 16 refs., 7 figs.

31839 (OEVS-Mitteilung–1988, pp. 583-586) **Problems of personnel dose monitoring in mixed β-γ radiation fields caused by type licensing of thermoluminescent dosimeters.** Heinzelmann, M. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Sicherheit und Strahlenschutz). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In the German Federal Republic TLD's to be used in gamma dosimetry must be type licensed according to legal specifications. In the type licensing the dosimeters must meet requirements making them unsuitable for beta dosimetry. In mixed beta-gamma radiation such dosimeters tend to underestimate high doses from beta radiation. It is therefore required that either a measuring unit 'individual dose equivalent, superficial' suitable both for beta- and gamma radiation is introduced in Germany, as an additional legally accepted measurement value for gamma rays. Or alternatively a threshold value of the gamma/beta dose ratio should be fixed. When this value is exceeded suitable beta dosimeters should be carried which however need not to be type licensed. 7 refs., 2 figs. (qui).

31840 (OEVS-Mitteilung–1988, pp. 587-591) **Fading of CaF/sub 2/-Tm (TLD-300).** Ben-Shachar, B. (Israel Atomic Energy Commission, Beersheba (Israel). Nuclear Research Center-Negev); Laichter, Y.; German, U.; Weiser, G. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Experiments on the fading of G-3 cards and TLD-300 chips, with different thermal treatments, were performed. For TLD-300 chips, with a pre-irradiation annealing of 400/sup 0/C/1h, the optimal post-irradiation annealing was found to be 110/sup 0/C/10min. The fading at these conditions was found to be about 5% per month. 5 refs., 4 figs., 1 tab.

31841 (OEVS-Mitteilung–1988, pp. 592-596) **Relative sensitivity of thermoluminescent materials to 15MeV neutrons. New experimental data with respect to the shape of the glow curve and influence of the encapsulating material.** Bos, A.J.J. (Interuniversitair Reactor Inst., Delft (Netherlands)); Dielhof, J.B.; Vries, W. de; Rasmussen, C.E.; Zoetelief, J.; Broerse, J.J. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The relative neutron sensitivity (k) of 11 commercially available, sintered TL-materials to 14,8MeV neutrons has been determined under well defined experimental conditions. The influence from three encapsulating materials (tissue equivalent A-150 plastic, teflon and the dosimeter material itself) has been investigated. Glow curves were recorded between 60 and 350/sup 0/C for both neutron and calibration (/sup 60/Co) irradiations. The k-values are determined for the integral TL-response and the TL-response per glow peak. For several TL-materials the shape of the neutron induced glow curve shows appreciable differences compared to the one after /sup 60/Co gamma irradiation. Intrinsic integral k-values vary from 0,00 (CaF/sub 2/:Mn) to 0,30 (/sup 6/LiF:Mg, Na), while individual glow peaks show k-values up to 2,35 (/sup 6/LiF:Mg, Ti, peak 7/8). For TL-materials containing /sup 6/Li, teflon as encapsulating material should not be used for measuring the intrinsic neutron sensitivity. Encapsulating in A-150 strongly enhances the response to neutrons of all TL-materials except for CaF/sub 2/:Mn. 7 refs., 1 fig., 2 tabs.

31842 (OEVS-Mitteilung–1988, pp. 597-602) **Radiation protection dosimetry of neutrons and photons at a high energy accelerator using a low pressure proportional counter.** Menzel, H.G. (Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.). Inst. fuer Biophysik); Schuhmacher, H.; Cartier, F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Microdosimetric proportional counters can be made to have a very good response in terms of dose equivalent quantities such as H/sup */(10) for a wide range of energies of neutrons and photons. Furthermore, this type of detector has useful diagnostic properties concerning the photon and neutron contribution to dose equivalent and generally radiation quality. Proportional counters based radiation protection dosimetry appears useful in complex and variable radiation fields. This paper reports on measurements at a 590MeV proton accelerator. 8 refs., 4 figs., 1 tab.

31843 (OEVS-Mitteilung–1988, pp. 501-508) **Comparative measurements on 30 whole-body counters.** Kunkel, R. (Universitaet des Saarlandes, Saarbruecken (Germany, F.R.)); Werner, E.; Schmier, W. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Intercomparison measurements on 9 persons were done at 30 whole-body counters in Austria, Switzerland, Netherlands and Federal Republic of Germany. Previously the radiopharmaca /sup 57/-Co-vitamin B12, /sup 59/Co-vitamin B12, /sup 59/Fe ascorbate and /sup 131/I hippuran-iodide was administered to them for medical

and scientific purposes. Difficulties of calibration are discussed. 7 figs., 1 tab. (qui).

31844 (OEVS-Mitteilung–1988, pp. 509-513) **25 years of in vivo measurements of transuranes at KFK.** Doerfel, H.R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

At KFK, large-area proportional counters with double anticoincidence measuring characteristic X-rays from plutonium and other transuranes were installed in 1961 and specialized for in vivo skeleton- and lung plutonium determinations: Difficulties in determination of Pu conjointly with Am-241 led to their replacement by commercial phoswitch detectors in 1976. Since Chernobyl things have changed completely: due to the high cesium body radioactivity these methods do not work any longer. It is therefore planned to install an additional lung counter with semiconductor detectors. 3 refs., 5 figs. (qui).

31845 (OEVS-Mitteilung–1988, pp. 614-620) **Investigation on the performance of a TEPC dose-equivalent meter for area monitoring.** Schmitz, T. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Medizin); Smit, T.; Morstin, K.; Mueller, K.D.; Booz, J. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A new working-area monitor based on a tissue equivalent, low-pressure proportional counter (TEPC) has been designed and constructed, which hereafter is referred to as the Juelich counter. The detector was optimized with regard to it's wall thickness to match the ambient dose equivalent H/sup */(10), i.e. the dose equivalent at 10mm depth in the ICRU sphere. The dimensions of the counter were chosen so that the sensitivity of the counter meets the desired specifications for area monitoring. In order to cover a dynamic range of about six decades in lineal energy, y, a nonlinear amplifying system was developed. The calculated response of the Juelich counter, with respect to H/sup */(10) as a function of incident neutron energy, is compared to experimental results. Furthermore, the statistical precision of the integral readings of the Juelich, counter as a function of simulated diameter, has been estimated. 8 refs., 4 figs.

31846 (OEVS-Mitteilung–1988, pp. 609-613) **Measuring time-dependent neutron flux from 14MeV neutron generators by radioactivation techniques.** Schulze, J. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Euskirchen (Germany, F.R.). Inst. fuer Naturwissenschaftlich-Technische Trendanalysen); Rosenstock, W. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The neutron fluence from the 14MeV neutron generator is determined by activation foils and fission chambers. U238 fission chambers are used to record the fluctuation of the neutron flux in time; this measurement is used to calculate the buildup and the decay of foil activity. Then from the foil activity the neutron fluence can be determined. This method is more accurate than the activation method alone since temporal variations of the neutron flux are taken into account. It turns out that with neutron flux variations by a factor of 2 the simple activation method may result in 60% error in neutron fluency. 1 ref., 5 figs.

31847 (OEVS-Mitteilung–1988, pp. 802-807) **Assessment of internal contamination with a whole body counter.** Havlik, E. (Vienna Univ. (Austria). Abt. fuer Nuklearmedizin); Bergmann, H. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Measurements of whole body radioactivity are performed in our department using a shadow shield whole body counter and automated gamma spectrum analysis. After the radioactive fallout in Austria due to the reactor accident in Chernobyl the instrument has mainly been used for the assessment of the radiation level in the general population. Amongst the radionuclides incorporated I 131 and Cs 137 had the highest activities. At present (Sep 1986) an increase of Cs 137 activity in the population is clearly observed. 2 refs., 4 figs.

31848 (ORNL–6544) **1987 Neutron and gamma personnel dosimeter intercomparison study using a D_2O-moderated ^{252}Cf source.** Swaja, R.E.; West, L.E.; Sims, C.S.; Welty, T.J. Oak Ridge National Lab., TN (USA). May 1989. 24p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89012923/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The thirteenth Personnel Dosimetry Intercomparison Study (i.e., PDIS 13) was conducted during April 1987 as a joint effort by Oak Ridge National Laboratory's (ORNL) Dosimetry Applications Research Group and the Southwest Radiation Calibration Center at the University of Arkansas. A total of 48 organizations (34 from the US and 14 from abroad) participated in PDIS 13. Participants submitted a total of 1,113 neutron and gamma dosimeters for this mixed field study. The dosimeters were transferred by mail and were handled by experimental personnel at ORNL and the University of Arkansas. The type of neutron dosimeter and the percentage of participants submitting that type are as follows: TLD-albedo (49%), direct interaction TLD (31%), CR-39 (17%), film (3%). The type of gamma dosimeter and the percentage of participants submitting that type are as follows: $Li_2B_4O_7$, alone or in combination with $CaSO_4$, (69%), ^7LiF (28%), natural LiF (3%). Radiation exposures in PDIS 13 were limited to 0.5 and 1.5 mSv from ^{252}Cf moderated by 15-cm of D_2O. Traditional exposures using the Health Physics Research Reactor (HPRR) were not possible due to the fact that all reactors at ORNL, including the HPRR, were shutdown by order of the Department of Energy at the time the intercomparison was performed. Planned exposures using a $^{238}PuBe$ source were negated by a faulty timing mechanism. Based on accuracy and precision, direct interaction TLD dosimeters exhibited the best performance in PDIS 13 neutron measurements. They were followed, in order of best performance, by CR-39, TLD albedo, and film. The $Li_2B_4O_7$ type TLD dosimeters exhibited the best performance in PDIS 13 gamma measurements. They were followed by natural LiF, ^7LiF, and film. 12 refs., 1 fig., 5 tabs.

31849 (ORNL/TM–11199) **Detectors for the superconducting super collider, design concepts, and simulation.** Gabriel, T.A. Oak Ridge National Lab., TN (USA). Jun 1989. 43p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89013336/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The physics of compensation calorimetry is reviewed in the light of the needs of the Superconducting Super Collider (SSC) detectors. The four major detector types: liquid argon, scintillator, room temperature liquids, and silicon, are analyzed with respect to some of their strengths and weaknesses. Finally, general comments are presented which reflect the reliability of simulation code systems.

31850 (RAL–89-014) **Performance of prototype position-sensitive neutron detectors on SXD at ISIS.** Wilson, C.C. Rutherford Appleton Lab., Chilton (UK). Feb 1989. 41p. Order Number DE89617350/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The performance of two position-sensitive neutron detector designed for use on the single crystal diffractometer (SXD) at ISIS is assessed. The two detectors examined were the Anger camera / sup 6/Li-glass scintillator PSD and a prototype fibre-optic encoded PSD based on /sup 6/Li-doped ZnS plastic scintillator. The latter detector is found to be both simpler to fabricate and to produce better results on the evidence to date. A summary of some of the expected science from SXD and the performance of the detectors with respect to this is also given.

31851 (SAND–89-0188C) **A one-dimensional scintillator camera for the SATURN x-ray simulation accelerator.** Fehl, D.L.; Lee, J.R.; Leeper, R.J.; Hedemann, M.A.; Stygar, W.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 28p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890694–1: Instrumentation for nuclear weapons effects testing conference, Monterey, California, USA, 5-8 Jun 1989). Order Number DE89009327/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

New x-ray diagnostics are needed to probe the efficiency of modern pulsed-power, flash x-ray simulator. In this talk we shall examine some of the critical diagnostic issues which pertain to the SATURN facility located at Sandia National Laboratories. Two new x-ray cameras have been developed for this simulator. A multiframe pinhole camera will be described in a companion talk at this conference. This talk focuses on a one-dimensional camera based on a fast scintillator array. I shall describe its construction, operation, and relative calibration. These cameras together have given us valuable insights into the workings of the SATURN x-ray source, and we shall examine in some detail the results from a SATURN experiment.

31852 (SLAC-PUB–4857) **Study of straw chamber lifetime with argon ethane.** Mir, R.; Adler, J.; Bolton, T.; Bunnell, K.; Cheu, E.; Grab, C.; Mazaheri, G.; Odian, A.; Pitman, D.; Stockhausen, W. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Mar 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890231–5: 5. international wire chamber conference, Vienna, Austria, 13-17 Feb 1989). Order Number DE89012786/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We present detailed laboratory measurements of the lifetime of a small test chamber, simulating the Mark III straw vertex chamber conditions. The tests were carried out with an argon ethane 50/50 gas mixture at 3 atmospheres absolute pressure and 3.9 kV was applied to the wires. After the accumulation of ~0.02 C/cm on a single straw continuous discharges began. The addition of alcohol or water vapor to the gas mixture was found to extend the lifetime of the straws. Continuous flow of the gas mixture with water vapor through the straws prolonged the lifetime significantly. We present preliminary results on the effects of changing the gas mixture inside the straws at regular time intervals. Adding a small percentage of water vapor to the argon-ethane gas and flowing the gas mixture in the straws can improve the lifetime by more than an order of magnitude. An accumulated charge of 1.0 C/cm on a single straw has been obtained. 7 refs., 4 figs.

31853 (SLAC-PUB–4940) **A calorimeter software trigger for the Mark II detector at SLC [Stanford Linear Collider].** Briggs, D.; Glanzman, T.; Grosse-Wiesmann, P.; Tinsman, J.; Holmgren, S.; Schaad, M.W. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (LBL–26974;CONF-890415–1: Computing in high energy physics, Oxford, UK, 10-14 Apr 1989). Order Number DE89012268/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A new FASTBUS-based calorimeter software trigger for the upgraded Mark II at the Stanford Linear Collider (SLC) is presented. The trigger requirements for SLC and a short description of the hardware used for this purpose are given, followed by a detailed description of the software. Some preliminary results are presented. 9 refs., 4 figs.

31854 (SLAC-PUB–4956) **Particle identification using dE/dx in the Mark II detector at the SLC.** Boyarski, A.; Coupal, D.P.; Feldman, G.J.; Hanson, G.; Nash, J.; O'Shaughnessy, K.F.; Rankin, P.; Van Kooten, R. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 16p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890231–4: 5. international wire chamber conference, Vienna, Austria, 13-17 Feb 1989). Order Number DE89012267/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The central drift chamber in the Mark II detector at the SLAC Linear Collider has been instrumented with 100-MHz Flash-ADCs. Pulse digitization provides particle identification through the measurement of average ionization loss in the chamber. We present the results of a study of system performance and outline the systematic corrections that optimize resolution. The data used are from a short test run at PEP with one-third of the FADCs installed and an extensive cosmic ray sample with the fully instrumented chamber. 11 refs., 9 figs.

31855 (SLAC-PUB–4966) **Triggering and data acquisition aspects of SSC tracking.** Hanson, G.G.; Niczyporuk, B.B.; Palounek, A.P.T. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 26p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-8901118–3: Workshop on triggering and data acquisition for experiments at the Superconducting Super Collider, Toronto, Canada, 16-19 Jan 1989). Order Number DE89012265/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Possible conceptual designs for wire chamber tracking systems which meet the requirements for radiation damage and rates in the SSC environment are discussed. Computer simulation studies of tracking in such systems are presented. Results of some preliminary pattern recognition studies are given. Implications for data acquisition and triggering are examined. 15 refs., 14 figs., 3 tabs.

31856 (SSI–88-07) **Radon decay product in-door behavior - parameter, measurement method, and model review.** Scofield, P. National Inst. of Radiation Protection, Stockholm (Sweden). 30 Mar 1988. 110p. Order Number DE89764823/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

This report reviews parameters used to characterize indoor radon daughter behavior and concentrations. Certain parameters that affect indoor radon daughter concentrations are described and the values obtained experimentally or theoretically are summarized. Radon daughter measurement methods are reviewed, such as, PAEC, unattached daughters, particle size distributions, and plate-out measurement methods. In addition, certain radon pressure driven/diffusion models and indoor radon daughter models are briefly described.

31857 The fermilalb E-760 charmonium detector. Ray, R. (Northwestern University, Evanston IL 60201(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 646-652 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

The masses and widths of many of the charmonium states are still notsufficiently well known to determine the relative contributions of the variousterms to the $c\bar{c}$ potential (spin-spin, tensor, etc.). The charmoniumregion also offers a number of other interesting physics possiblities along thelines of exotics, glueballs, etc. The Fermilab E-760 detector has been designedto address many of these issues. A brief description of the detector and theanticipated physics program is given.

31858 The use of TPC's as target region detectors in the MPS. Foley, K. J. (Brookhaven National Laboratory, Upton, New York 11973(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 643-645 (25 Apr 1989). DOE Contract AC02-76CH00016. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

An important criterion for detectors near the target in the MPS isthe need to minimize the amount of material in the path of particlesentering the main drift chamber system. This is difficult to achievewith standard wire chambers because of the need to support tension inthe anodes and field wires. The time projection chamber can have asignificant advantage in this case since the active volume is the driftregion, and the parts of the chamber with critical wires can be locatedvery much "out of the way," near the

magnet pole. Other than gas containment,one has just to arrange to support a field cage to provide a uniformelectric field. (AIP)

31859 The Crystal Barrel at LEAR. Amsler, C. (Physik-Institut der Universitat Zurich, Schonberggasse 9, CH-8001 Zurich(CH)). *AIP (American Institute of Physics) Conference Proceedings (USA)*, 185(1): 653-660 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

The Crystal Barrel is a 4π magnetic detector with good efficiency andgood angular and momentum resolutions for the detection of multiparticle finalstates that include several photons. It is especially suited for the study oflow energy $p\bar{p}$ and e^+e- annihilations. The detector is presentlybeing constructed at LEAR for meson spectroscopy in $\bar{p}p$ annihilation atrest and up to 2 GeV/c. It will become fully operational in 1989.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

31860 (ACIESP–60(v.3), pp. 151-155) **Rotational motion of an artificial satellite perturbed by solar radiation pressure.** Moraes, R.V. de (Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. Tecnologico de Aeronautica); Zanardi, M.C. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology*. Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

The motion of a satellite about its center of mass is studied using a semi-analytical method. Torques produced by conservative and non conservative forces are considered. An analytical model is proposed for solar radiation torques. Andoyer variables are used to describe the rotational motion. Analytical equations are used to transform osculating to a mean set of differential equations. Since the mean equations are more slowly varying, a numerical integration using large step size can be performed to obtain the mean state at a later time.

31861 (AERE-M–3708) **Modelling of MOSFET inversion layer conductivity using the resistor network method.** Kingdon, R.D.; Rawlings, K.J.; Morris, S.T. UKAEA Harwell Lab. (UK). Theoretical Physics Div. Oct 1988. 19p. Available from H.M. Stationery Office, London, price Pound 8.00.

The subthreshold conductance of a MOSFET is smaller than predicted by elementary theory because of inhomogeneity in the inversion layer channel. Prediction of the true conductance thus requires specification of the degree and type of inhomogeneity plus a knowledge of how this suppresses the conductance. To investigate the latter effect the quasi two dimensional MOSFET channel has been simulated by a two dimensional resistor network. This method is computationally efficient and very versatile regarding the choice of inhomogeneity. The starting point for the research is that radiation directly affects the homogeneity of the MOSFET inversion layer. Therefore, a study of radiation damage requires an understanding of the effects of inhomogeneities and an ability to model them. The effects can be used to measure the radiation dose as in radiation dosemeters, or they may need to be suppressed for devices used in space.

4403 Miscellaneous Instruments

Refer also to citation(s) 30320, 30593, 30866, 30875, 31110, 31336, 31589, 31622, 31892, 31905, 31925, 31938, 31939, 31940, 32411, 32834, 32988

31862 (ANU-P–979) **Gridded buncher - far field extension using carbon coated teflon/sub R/sleeves.** Weisser, D.C.; Malev, M.D. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Aug 1987. 7p. Order Number DE89617385/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Gridded bunchers operating at low frequency, are limited in the acceptable particle velocity by the non-bunching effect of the R.F. fields between the external grounded surface and the grids. The three-frequency gridded buncher, based on 9.375 MHz, at Canberra, was provided with 24 cm long carbon coated teflon sleeves to extend the far field regions. The sleeves act as distributed resistors, smoothly grading the far field region over a distance of 30 cm. The bunching efficiency is constant at 65% for beams which travel up to 17 cm in one 9.375 MHz cycle.

31863 (CONF-881079–2) **Nuclear magnetic resonance imaging for quality control in the production of advanced ceramic components.** Ackerman, J.L.; Garrido, L.; Ellingson, W.A. Argonne National Lab., IL (USA). Oct 1988. 11p. Sponsored by DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Superconductivity '88; Boston, Massachusetts, USA; 19 Oct 1988. Order Number DE89013309/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

NMR imaging of materials presents special difficulties not encountered in the imaging of water in biological tissues. However, there is a rich variety of measurement techniques available through, as well as materials systems which could be profitable examined by, NMR imaging. This field of research is still in its infancy. In the present paper, we touch on a number of examples of systems amenable to study by NMRI methods, along with the technical approaches capable of producing images of acceptable quality. In the next year or two, the coming availability of NMR imaging hardware suitable for materials will permit a much-needed evaluation of the potential for these exciting new techniques to contribute to knowledge about the creation, processing, testing and use of new materials. 14 refs.

31864 (MLM–3586) **A critique of trennschaukel operation.** Taylor, W.L. EG and G Mound Applied Technologies, Miamisburg, OH (USA). 28 Apr 1989. 132p. Sponsored by DOE Energy Research. DOE Contract AC04-88DP43495. Order Number DE89012824/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report examines in detail the theory of operation of the "trennschaukel," or swing separator. The trennschaukel is an experimental device that has been used with considerable success to measure the thermal diffusion factor in binary gas mixtures. The mathematical formalism, which is given in some detail, is rather complicated, and an attempt was made to illustrate the gas behavior with intuitive arguments and pictorial diagrams. Two actual experimental devices, one designed for high temperature and the other for cryogenic measurements, which have been in use for a number of years, are described and illustrate the importance of the operating conditions. 3 refs., 27 figs.

31865 (SAND–88-2907) **The PVDF [polarized polyvinylidene fluoride polymer film] piezoelectric polymer shock-stress sensor: Signal conditioning and analysis for field test application.** Reed, R.P.; Greenwoll, J.I. Sandia National Labs., Albuquerque, NM (USA). May 1989. 27p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8811100–3: 5. state-of-the-art blast instrumentation, Albuquerque, New Mexico, USA, 15-16 Nov 1988). Order Number DE89013348/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The PVDF shock sensor is a piezoelectric polymer transducing element that converts stress to charge. This unusually versatile sensor allows accurate measurement of stress pulses of durations up to milliseconds with resolution of nanoseconds over a range of a few bars to at least 0.5 Mbar. Its measurement characteristics depend significantly on stress waveform and circuitry. Field test applications require special consideration of signal conditioning, system characterization, and data analysis. This report describes some unfamiliar characteristics of the PVDF sensor and a field-validated hybrid (complementary hardware and software) approach to the general measurement problem as encountered under field test conditions. Discussed are the use of the sensor, for estimation of signal voltage, through characterization and correction for system properties, design, and realization of special filters, to reduction of observed voltage to the stress experienced by the sensor. 9 refs., 10 figs., 1 tab.

31866 (SAND–88-3153) **The effects of snow on landmarks in K_u band SAR [Synthetic Aperture Radar] images.** Murrary, M. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 107p.

Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89013141/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report documents research into the effects of snow on candidate landmarks for the TFS radar. It includes a discussion of a simple snow model, relevant backscatter data from previous ground based collections, predictions of the effects of snow coverage based on this data, a discussion of the snow data collection with the TFS radar, and an analysis of the results of that collection. All SAR images are for a K_u band radar, with HH polarization, and a 30° depression angle. The images have three meter resolution and a one kilometer swath. SAR images were collected of both rural and urban landmarks. 5 refs., 7 figs., 19 tabs.

31867 (SAND–88-3388C) **Pyramidal horns: Part 1: Simple expressions for directivity as a function of aperture phase error.** Aurand, J.F. Sandia National Labs., Albuquerque, NM (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890660–4: Institute of Electrical and Electronics Engineers (IEEE) Antennas Propagation Society (AP-S) international symposium, San Jose, California, USA, 26-30 Jun 1989). Order Number DE89005209/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Pyramidal horn antennas are popular because they offer high gain, low VSWR, very pure linear polarization, and mechanical simplicity. When used as standard-gain antennas in measurement situations, the gain and directivity are critical parameters, and theoretical analysis of the directivity is essential. This paper presents approximate equations for the directivity of pyramidal horns. These equations are accurate and much easier to evaluate that the exact equations, which involve complicated Fresnel integrals. The formulas are expressed in terms of gain-reduction factors, based on the quadratic phase errors in the aperture. 3 figs.

31868 (SAND–88-3389C) **Pyramidal horns: Part 2, A novel design method for horns of any desired gain and aperture phase error.** Aurand, J.F. Sandia National Labs., Albuquerque, NM (USA). 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890660–3: Institute of Electrical and Electronics Engineers (IEEE) Antennas Propagation Society (AP-S) international symposium, San Jose, California, USA, 26-30 Jun 1989). Order Number DE89005346/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Pyramidal horn antennas are often used because of their well-characterized radiation performance, including precise gain as a function of size and very pure linear polarization. When designing pyramidal horns, previous methods have involved approximations and inefficient trial-and-error solutions. This paper presents a novel numerical method for determining the exact horn dimensions for any desired gain. It utilizes exact relationships to yield the required aperture dimensions and horn length, given an operating frequency, waveguide dimensions, and allowable quadratic phase errors in the aperture. 1 fig.

31869 (SAND–88-3465C) **A 1-D, hard x-ray pinhole camera for flash x-ray pulsed-power accelerators.** Fehl, D.L.; Leeper, R.J.; Lee, J.R.; Hedemann, M.A.; Stygar, W.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 16p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–1: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89011886/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A time-resolved pinhole camera has been constructed to diagnose the x- ray emitting source of the SATURN accelerator. The detector for the camera is a 20-channel, linear array of plastic scintillators, placed beneath adjustable jaws; optical signals are connected by fiber-optic links to a remote bank of photomultiplier (PM) tubes. Variations in the channel-to-channel response have been reduced by exposing the complete array to a nearly uniform pulsed x-ray field (Febetron 706, e-beam tube with Ta converter) and adjusting the gains on the PM tubes. Experiments under SATURN to date have yielded information on the simultaneity of the source rings, x-ray pulse widths, and the duration of hot spots. The camera complements existing diagnostics, such as time-integrated and multiframe, gated cameras and non- spatially resolved PIN and scintillator-photodiode detectors. 6 refs., 10 figs.

31870 (SAND–88-7169C) **A novel TR [transmit/receive] switch utilizing a distributed amplifier.** Byrnes, S.J.; Beyer, J.B. Sandia National Labs., Albuquerque, NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890678–1: IEEE MTT-S international microwave symposium, Long Beach, California, USA, 13-15 Jun 1989). Order Number DE89005917/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The operation of a large signal class B distributed amplifier as a narrowband transmit/receive switch is described. A four stage MESFET distributed amplifier with more than −30 dB of directivity over a 12 percent bandwidth with a center frequency at X-band is presented. 3 refs., 6 figs.

31871 (SAND–89-0242) **Characteristics of select glass tube preconcentrators used with an ion mobility spectrometer.** Hannum, D.W. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 50p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE89012896/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Experiments were run using a PC-100 ion mobility spectrometer and TNT explosive vapor source to evaluate the adsorb-desorb characteristics of select 6.2 mm O.D. by 4.0 mm I.D. by 76.2 mm long glass preconcentrator tubes. This study was done to aid in the continuing search for an efficient preconcentrating device to be used with explosive vapor detecting instruments. These tubes were tested at various sampling rates ranging from 60 to 510 ml/min and the samples were thermally desorbed to provide the maximum output signal. Data showed the tubes with the greatest internal surface area for the explosive molecules to stick to produced the best desorption results, namely the glass wool packed tubes. Correlation between tube type and sampling flows with respect to maximum output signal proved to be significant, along with the individual tube desorption profiles. 23 figs.

31872 (SAND–89-0267C) **Demonstration of a Time Projection Compton Spectrometer.** Baldwin, G.T.; Landron, C.O.; Lee, J.R.; Leeper, R.J.; Lorence, L.J. Jr. Sandia National Labs., Albuquerque, NM (USA). 1989. 20p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890694–5: Instrumentation for nuclear weapons effects testing conference, Monterey, California, USA, 5-8 Jun 1989). Order Number DE89010743/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Time Projection Spectrometer, or TPCS, is a device that we have developed to determine the energy spectrum of x rays from short-pulse, high-intensity sources. We use the TPCS to measure x-ray energies above 100 keV, for sources with endpoint energies no higher than about 2 MeV. In this paper, I will first describe the device and how it works, then present the results and analysis of our tests on SPEED. I will discuss sources of error and conclude by summarizing the advantages and suitability of the TPCS approach.

31873 (SAND–89-0301C) **The Saturn x-ray framing camera.** Stygar, W.A.; Ives, H.C.; Kensek, R.P.; Brock, E.R.; Allen, K.; Cuny, J.; Fehl, D.L.; Ghiglia, D.C.; Halbleib, J.A.; Harper-Slaboszewicz, V. Sandia National Labs., Albuquerque, NM (USA). 1989. 17p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890694–2: Instrumentation for nuclear weapons effects testing conference, Monterey, California, USA, 5-8 Jun 1989). Order Number DE89009945/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper is an outline of a talk given on the x-ray framing camera used with the Saturn accelerators. (JF)

31874 (SAND–89-0337C) **Fiber optic sensing in a high explosives environment.** Owenby, R.N. Sandia National Labs., Albuquerque, NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890694–6: Instrumentation for nuclear weapons effects testing conference, Monterey, California, USA, 5-8 Jun 1989). Order Number DE89010863/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents results in applying fiber optic technology to high explosives experiments, including: detonation light arrival time, shock wave analysis, control lines, and pressure sensing. In the correct experimental configuration, coaxial and fiber optic cable can provide excellent signals, but the fiber optic cable's characteristics under high explosive shock environments provide superior signal definition. Enhanced frequency response and cost effectiveness provide an excellent basis for future optical sensor development. Experiments were conducted comparing the signal response of several shock wave time-of-arrival methods i.e., fabricated mechanical switches, piezoelectric pin configurations, and a plastic fiber optic sensor system. The fiber optic signals were better defined and had a faster response. Fiber optic sensors with two different configurations were used as detonation light sensors. The sensors were oriented in a perpendicular and normal configuration with respect to the plane of detonation and multiple non-time-coincident signals were lensed together into a common instrument fiber. 6 refs., 12 figs.

31875 (SAND–89-0593) **A fiber optic test system for quantum efficiency measurements.** Pfeifer, K.B.; Jenkins, M.W. Sandia National Labs., Albuquerque, NM (USA). May 1989. 23p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Orcer Number DE89012823/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A design for a photodetector quantum efficiency measurement test system is presented. The system hardware and control software are explained and the measurement theory is given. A brief discussion of the operation of the prototype is given. Finally, the article concludes with an example of a quantum efficiency measurement of a sample and a discussion of the errors involved in the measurement. 9 refs., 7 figs.

31876 (SAND–89-1263C) **Sandia's UGT Instrumentation Development Program: INWET'89 Paper No. 15.** David, R.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 16p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890694–7: Instrumentation for nuclear weapons effects testing conference, Monterey, California, USA, 5-8 Jun 1989). Order Number DE89010864/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Field Instrumentation Department of Sandia National Laboratories provides instrumentation and field support for nuclear weapons effects tests at the Nevada Test Site. A key element of this activity is the development of data acquisition and recording systems. This paper provides an overview of the instrumentation currently in use and development projects in progress. Projected requirements and future development plans are also discussed briefly. 4 refs., 8 figs.

31877 (STEV-NYEL–89-1) **Spectral measurement SMHI. Final report.** Dahlgren, L. Statens Energiverk, Stockholm (Sweden). Jan 1989. 35p. (In Swedish). Order Number DE89766924/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

A spectroradiometer based on a 1/8 meter focal length single grating monochromator has been developed. It is intended for measurements of natural or simulated solar spectral irradiance in the wavelength range 800-1800 nm. Wavelength settings, data acquisition and some data computations are made using a single board computer, with possibility to transfer data from and to a VAX computer. The cosine correction input of the spectroradiometer is configured to be reasonably good.

31878 (UCRL–100185) **Numerical modeling of monopoles on radial-wire ground screens.** Burke, G.J.; Miller, E.K. Lawrence Livermore National Lab., CA (USA). 29 Dec 1988. 4p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890660–2: Institute of Electrical and Electronics Engineers (IEEE) Antennas Propagation Society (AP-S) international symposium, San Jose, California, USA, 26-30 Jun 1989). Order Number DE89005350/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The monopole antenna on a radial-wire ground screen has been particularly resistant to numerical modeling due to the difficulty of treating the effect of the air-ground interface and the large total electrical length of wire involved. Designs are usually based on empirically derived formulas and practices. A moment-method code capable of modeling ground screens and other antennas near to or buried in the ground was developed in the code NEC-3. A version of NEC-3, known as NEC-GS, was then specialized to model vertical monopoles on uniform radial-wire ground screens, taking maximum advantage of the symmetry of the screen and its currents. Some results of this code are presented here to compare the performance of ground screens of varying dimensions and configurations, and to determine optimum design parameters. 5 refs., 4 figs.

31879 (UCRL–100189) **Recent improvements to the model for wire antennas in the code NEC [Numerical Electromagnetics Code].** Burke, G.J. Lawrence Livermore National Lab., CA (USA). 29 Dec 1988. 5p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. (CONF-890660–5: Institute of Electrical and Electronics Engineers (IEEE) Antennas Propagation Society (AP-S) international symposium, San Jose, California, USA, 26-30 Jun 1989). Order Number DE89005648/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Numerical Electromagnetic Code (NEC) involves a moment-method model for thin wires based on point matching and sinusoidal-spline basis functions. The NEC algorithm, which has been in use since about 1978, has recently been modified to improve the accuracy for wires with discontinuous radius and tightly coupled junctions and to avoid loss of precision in modeling electrically small antennas. To model wires with discontinuous radius, the current is now located on the wire surface with match points on the axis, reversing the previous convention. Openings in the surface at wire ends, voltage source gaps and steps in radius are closed with radial caps so that location of match points on the axis is justified under the extended boundary condition. A condition on charge density at junctions is established by a small moment-method solution for continuity of scalar potential at each junction or change in radius. Steps to improve precision at low frequencies include changes in the evaluation of basis functions and field due to a segment, and a provision to use a constant basis and weighting function around selected small loops. The new developments in NEC will be briefly described and results of the changes demonstrated. 4 refs., 3 figs.

31880 **Proceedings of the industrial temperature measurement symposium.** Kevlin, T.W.; Katz, E.M. vpUniversity of Tennessee at Knoxville, Knoxville, TN (1985). (CONF-8409109–: Industrial temperature measurement symposium, Knoxville, Tennessee, USA, 10-12 Sep 1984).

This book contains 28 papers. Some of the titles are: Problems in high temperature thermocouple thermometry; Recent advances in high temperature thermocouples; Modelling of temperature sensors; A new development: Iridium thin film temperature sensor; and Applications of radiation thermometry - an overview.

31881 **Laser-based photoacoustic densitometer for two-dimensional scanning of thin-layer chromatographic plates.** Kawazumi, H. (Ames Laboratory-USDOE and Department of Chemistry, Iowa State University, Ames, Iowa 50011(US)); Yeung, E. S. *Applied Spectroscopy (USA),* 43(2): 249-252 (Feb 1989). DOE Contract W-7405-ENG-82.

Laser-based photoacoustic densitometry was applied totwo-dimensional analysis in thin-layer chromatography. Anacousto-optic device was used to provide both intensity modulationand a rastering scan. The spatial resolution is 25×60 spots for anarea of 25×50 mm on the thin-layerchromatograhic plate. Three detection modes, normal modulation,resonant modulation, and unmodulated rapid scan modes were compared.Detection limits in the most sensitive mode and in the fastest mode are350 pg with scan time of 153 s and 6.9 ng with scan time of 1.5 s,respectively.

31882 **Anomalous dispersion effects in diffuse reflectance infrared fourier transform spectroscopy: A study of optical geometries.** Hembree, D. M., Jr. (Plant Laboratory, Oak Ridge Y-12 Plant, Martin Marietta Energy Systems, Inc., Oak Ridge, Tennessee 37831(US)); Smyrl, H. R. *Applied Spectroscopy (USA),* 43(2): 267-273 (Feb 1989). DOE Contract AC05-84OR21400.

In this report, the two most common diffuse reflectanceinfrared Fourier transform spectroscopy (DRIFTS) optical geometries(on-axis and off-axis) are investigated in terms of adherence to theKubelka-Munk theory. It was found that specular reflection, whether inthe form of regular Fresnel reflection or diffuse Fresnel reflection,is the

major cause of spectral distortion in typical diffusereflectance measurements. A discussion of the origin of the variationin specular background associated with resonances is presented.Once the adverse effects of specular reflection are minimized, thelinear relationship between response and concentration predictedby Kubelka-Munk theory was found to extend to concentrated samples.Up to a point, this was the case even for intense absorption bandswhere anomalous dispersion leads to large changes in specular intensity.

31883 Molecular absorption measurements by FT/UV-Vis spectrometry. Glick, M. R. (Department of Chemistry, University of Florida, Gainesville, Florida 32611(US)); Jones, B. T.; Smith, B. W.; Winefordner, J. D. *Applied Spectroscopy (USA),* 43(2): 342-344 (Feb 1989).

Fourier transform spectrometry in the UV-Vis region (FT/UV–Vis),because it is source shot-noise limited, has a signal-to-noise ratio(S/N) disadvantage in comparison to dispersive spectrometry, especiallywith dense spectra. At the expense of poorer S/N, FT/UV-Vis can besatisfactory for high-resolution measurements. However, low-resolutionspectroscopic studies, such as molecular absorption measurements, arenot expected to be performed advantageously by FT/UV-Vis. The broad,dense spectra with intensity throughout a wide spectral range shouldshow a significant S/N degradation, in comparison to results withdispersive spectrometry. To investigate these expectations, we have useda Michelson interferometer to obtain low-resolution molecular absorptionspectra of polycyclic aromatic hydrocarbons (PAHs). (AIP)

31884 Saturation behavior of silicon Auston switches. Dunham, M. E. (EG&G Energy Measurements, Inc., P. O. Box 809, Los Alamos, New Mexico 87544(US)); Ziemba, F.; Moross, J. *Journal of Applied Physics (USA),* 66(1): 413-418 (1 Jul 1989).

The laser-energized photoconductive switch (Auston switch) has beendescribed previously with various applications. We report new measurementsinvestigating the physical behavior of several types of silicon Auston switches,establishing basic quantum efficiency, charge-voltage behavior, and voltage-timeresponse. Previously predicted nonlinear effects are observed, resulting indepartures from ideal performance for most designs. However, operation in thesaturated mode and a transmission line environment allows several designs toproduce a step waveform that gives previously unattainable combinations ofamplitude and rise time. In particular, the goal of a low aberration, 150-V,35-ps step has been achieved, and process parameters affecting this performanceare described.

31885 Compact scanning soft-x-ray microscope using a laser-produced plasma source and normal-incidence multilayer mirrors. Trail, J. A. (Department of Applied Physics, Ginzton Laboratory, Stanford University, Stanford, California 94305(US)); Byer, R. L. *Optics Letters (USA),* 14(11): 539-541 (1 Jun 1989).

We have constructed a scanning soft-x-ray microscope that uses a laser-produced plasma as the soft-x-ray source and normal-incidence multilayer-coated mirrors in a Schwarzschild configuration as the focusing optics. The microscope operates at a wavelength of 14 nm, has a spatial resolution of 0.5 μm, and has a soft-x-ray photon flux through the focus of 10^4 sec^{-1} when operated with only 170 mW of average laser power. The microscope is compact; the complete system, including the laser, fits on a single optical table.

31886 Pulsed molecular-beam, diode-laser spectrometry using rapid scanning techniques. De Piante, A. (Los Alamos National Lab, CLS-4, MS J567, Los Alamos, New Mexico 87544(US)); Campbell, E. J.; Buelow, S. J. *Review of Scientific Instruments (USA),* 60(5): 858-862 (May 1989).

We describe a diode-laser spectrometer for obtaining direct absorption, rovibrational spectra of monomers and/or weakly bound, molecular complexes which are found in supersonic expansions. The spectrometer incorporates a tunable, semiconductor diode-laser source and a pulsed-gas slit nozzle. White cell optics are used in the vacuum chamber to increase effective path length, and a Fabry–Perot etalon is used for relative frequency calibration. Stabilization of the source output is accomplished by locking onto a zero crossing of the etalon fringe-spacing pattern with a gated integrator. The diode laser is scanned rapidly (~0.2 cm^{-1}/ms) to modulate absorption signals at frequencies which can be electronically filtered from source noise. For 2000 scans, absorbances as small as 1.3×10^{-5} (0.003% absorption) can be detected. Amplitude fluctuations in the detected signal due to interference effects in the optics and gain variations in the diode laser are eliminated by recording data with and without gas flow from the nozzle, then performing the appropriate subtractions. Because source drift and multiple crossing-angle effects contribute $\leq$0.0005 cm^{-1}, observed linewidths (0.003 cm^{-1}) were determined to be laser limited. Data obtained on the van der Waals molecule (Ar·Co) are presented and discussed.

31887 Transmission filter for the extreme ultraviolet spectral region composed of a thin Saran ($C_2H_2Cl_2$) foil. Seely, J. F. (U. S. Naval Research Laboratory, E. O. Hulburt Center for Space Research Washington, DC 20375-5000(US)); Shirey, L.; Kingman, A. *Applied Optics (USA),* 28(10): 1818-1821 (15 May 1989).

Saran foils of 4000-A thickness have been fabricated and used astransmission filters in the extreme ultraviolet spectral region. Thetransmittances of the Saran foils were determined for the 20–620-Awavelength region. The foils transmitted radiation with wavelengths between the*L* absorption edge of chlorine at 61.4 and ~120 A.

31888 Simple compact monochromatic imaging system for plasma diagnostics. Williamson, R. L. (Sandia National Laboratories, P. O. Box 5800, Albuquerque, New Mexico 87185(US)); Hareland, W. A.; Peebles, H. C. *Applied Optics (USA),* 28(12): 2201-2203 (15 Jun 1989). DOE Contract AC04-76DP00789.

A simple compact monochromatic imaging system for plasma diagnostics isdescribed. The system consists of a small monochromator, single lens, and videocamera.

31889 Operation of a quasioptical gyrotron with variable mirror separation. Fliflet, A. W. (High Power Electromagnetic Radiation Branch, Plasma Physics Division, U.S. Naval Research Laboratory, Washington, D.C. 20375-5000(US)); Hargreaves, T. A.; Manheimer, W. M.; Fischer, R. P.; Barsanti, M. L. *Physical Review Letters (USA),* 62(23): 2664-2667 (5 Jun 1989).

Results from a quasioptical gyrotron experiment with a 20–28-cmmirror separation are presented showing operation from 95–130 GHz atpowers up to 148 kW and output efficiencies up to 12%. The output couplingcould be varied from 0.4%–3% by changing the mirror separation andoperating frequency. Efficiency optimization by variation of output couplingand by tapering the magnetic field has been demonstrated and regions ofsingle-mode operation at powers up to 125 kW have been characterized.

31890 Surface-extended x-ray-absorption fine-structure experiments at atmospheric pressure by means of a photocathode proportional counter with monolayer sensitivity. Long, G. G. (National Institute of Standards and Technology, Gaithersburg, Maryland 20899(US)); Fischer, D. A.; Kruger, J.; Black, D. R.; Tanaka, D. K.; Danko, G. A. *Physical Review [Section] B: Condensed Matter (USA),* 39(15): 10651-10657 (15 May 1989).

Surface-extended x-ray-absorption fine-structure measurements at atmospheric pressure were made by means of a new photocathode proportional counter on the oxide films that form on bulk iron substrates. Both thermally formed and chemically formed films were studied. Near-edge spectra with effective monolayer sensitivity were used to investigate the ionicity of cations in ultrathin films.

45 EXPLOSIONS AND EXPLOSIVES

31891 (AD-A–204460/0/XAB) **Expert-system approach to large space-systems control. Technical report, September 1987-October 1988.** Gartrell, C.F.; Baracat, W.; Skiffington, B. Generay Research Corp., McLean, VA (USA). Oct 1988. 260p. Available from NTIS, PC A12/MF A01.

The purpose of this project was to develop a technique that will reduce the need for high-fidelity models for the control synthesis process, provide a robust control implementation, and relieve computational burdens by utilizing artificial-intelligence techniques, notably expert systems, to implement control systems for large SDI space systems. Extending an earlier proof-of-concept investigation, this research proceeds beyond simple control laws, low bandwidths, and exact pattern encoding/matching approaches to include modern

control laws, higher bandwidths, and partial match-inferencing procedures. Three control implementations, Direct-Velocity Feedback, Independent Modal Space Control, and an Expert-System Controller were developed and various simulations performed to verify and compare performance. The primary finding is that an ESC has performance comparable to the numeric approaches and has a superior performance when there are changes in the system being controlled. That is, an ESC indeed demonstrates a robust control implementation.

31892 (SAND–88-2098C) **Standardized piezoelectric polymer (PVDF) gauge for detonator response measurement.** Moore, L.M.; Graham, R.A.; Reed, R.P.; Lee, L.M.; Bauer, F.; Warren, T.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8906118–1: International conference of the GTPS, La Grande Motte, France, 5-9 Jun 1989). Order Number DE89010437/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Time-resolved measurements of pressure profiles from the detonation of explosive devices have proven to be essential for detailed study of device performance. At present such measurements are routinely carried out with laser velocity interferometer (VISAR) systems, electromagnetic particle velocity gauges or piezoresistant (Manganin) gauges. One of the most promising new gauges to appear in recent years is the piezoelectric polymer gauge (PVDF) which has been standardized for general use based on the materials processing techniques developed by Bauer. The special problems presented by small size piezoelectric polymer gauges and nonplanar impacts are studied over a range of impact conditions. The response of 1 mm by 1 mm active area PVDF gauges under precisely controlled compressed-gas gun impacts shows highly reproducible results to pressures of 20 GPa. For the PVDF gauge which is placed within 12 microns of the impact surface and under approximately planar loading with small detonator flyer plates, PVDF gauge signals appear to be reduced by about 15% compared to the compressed-gas gun loading response. For highly nonplanar flyer impacts the PVDF signals are reduced by about 35%. In all stress environments, high quality, time-resolved current pulses are observed. 13 refs., 10 figs., 2 tabs.

4501 Chemical

Refer also to citation(s) 31583, 31871, 31874

31893 (LA–10773-Add.) **Shock initiation modeling of multicomponent explosives.** Partom, Y. Los Alamos National Lab., NM (USA). May 1989. 34p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89012259/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the main body of this report, we had developed a characteristics code for shock initiation based on the surface-burn, hot-spot growth mechanism. In this Addendum, we extend the code to include multicomponent materials. We demonstrate the capability of the code by four examples: (1) a two-component system of explosive and inert, (2) a two-component system of two different explosives, (3) prediction of the pop plot of 1.89 g/cm^3 PBX 9502 and comparison with experiment, and (4) a three-component system of different grain sizes. We then introduce the concept of critical hot-spot size for ignition and demonstrate its use to model the crossover effect in reaction rate for fine-grained explosives. 4 refs., 44 figs.

31894 (LA-UR–88-4130) **High explosives reaction model and its application to booster performance.** Tang, P.K. Los Alamos National Lab., NM (USA). 1989. 11p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890661–2: 3. international symposium on behavior of media under high dynamic pressures, La Grande Motte, France, 5-9 Jun 1989). Order Number DE89005459/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Initiation of insensitive high explosives requires a boosting system using more sensitive and usually more energetic explosives. However, problems arise if the booster material is too energetic. The initiability of some insensitive but less energetic high explosives can be enhanced by lowering the density and decreasing the grain size or by adding a sensitive component; thus these explosives can be used as booster materials. This paper presents a unified initiation and detonation reaction model and then the simulation of the development of the detonation wave in a PBX-9502 main charge using three booster explosives: low-density superfine TATB, low-density ultrafine TATB, and X-0407. The last two are found to be acceptable for booster application. 12 refs., 5 figs.

31895 (SAND–88-2813C) **Characterization of booster-rocket propellants and their simulants.** Weirick, L.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8905134–1: JANNAF propulsion meeting, Cleveland, Ohio, USA, 22-25 May 1989). Order Number DE89012497/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A series of experiments on a composite and an energetic propellant and their simulants were recently completed on a light-gas gun. The initial objectives were to obtain Hugoniot data, to investigate the pressure threshold at which a reaction occurs, and to measure spall damage at various impact velocities. The Hugoniot data measured for the propellants fit the Hugoniot curves provided by the manufacturer of the propellants extremely well and the Hugoniot curves developed for the simulants matched those of the propellants. Threshold pressures to initiate reactions in the composite and energetic propellants were found to be 40 and 3 kbars, respectively. In spall tests, the composite propellant and its simulant exhibited spall strengths around 0.25 and 0.18 kbar, respectively. The energetic propellant and its simulant were somewhat stronger with spall strengths just above 0.33 and 0.22 kbar. 12 refs., 9 figs., 6 tabs.

31896 (SAND–89-0512) **Application of a mixture theory model to the dispersal of solid by a high-pressure gas.** Geller, A.S.; Ratzel, A.C.; Baer, M.R. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 60p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89011297/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Characterizing the explosive dispersal of inert solid particles is of interest in a number of applications. A mixture theory approach is used to calculate the radial motion of the gas-solid mixture as it expands into an infinite atmosphere. Two initial gas-solid configurations are considered. In the first, a core of high pressure gas initially at rest is surrounded by a porous shell of the solid. The other configuration considered is a uniform mixture of solid and gas throughout the sphere. An adaptive finite element method is used to solve the set of partial differential equations for mass, momentum and energy conservation in each phase as well as the compaction equation for the time evolution of solid volume fraction. An adaptive grid scheme is used to refine the mesh to limit discretization errors. This places a fine mesh near the porosity and pressure fronts and greatly reduces the spatial resolution in areas of relatively constant pressure and volume fraction. The dispersal of the solid for the two initial configurations shows quite different behavior. For the gas core and porous shell, the solids are initially compacted to a maximum density of ~80–90% in a very thin region before rapidly dispersing to a broad concentration distribution. For the homogeneous gas-solid sphere, however, there is only a slight compaction region at the leading edge of the expanding gas, and the concentration of solid decays rapidly. 25 refs., 32 figs., 5 tabs.

31897 (UCRL–100064) **Viscosity of solids determined by shock wave action on hemispherical indentations.** Maiden, D.; Mitchell, A.; Wilkins, M. Lawrence Livermore National Lab., CA (USA). 31 Jan 1989. 15p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890661–7: 3. international symposium on behavior of media under high dynamic pressures, La Grande Motte, France, 5-9 Jun 1989). Order Number DE89008035/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An experimental technique for determining the viscosity of solids is investigated. The technique was developed by Mali from the Institute of Hydrodynamics at Novosibirsk. It involves determining the jet-no-jet condition from a shock wave impacting a plate with hemispherical indentations. The indentation radius when a jet does not form identifies a critical Reynolds number. Numerical simulations of the experiment are performed using a viscoplastic constitutive model. The viscosity is determined by adjusting it until the speed of

the jet and the critical Reynolds number match experiment. Results show that the viscosity of copper is two orders of magnitude lower than Mali's, but are in agreement with data derived from shock wave profiles by USA authors. 10 refs., 12 figs., 3 tabs.

4502 Nuclear

Refer also to citation(s) 31168, 31170, 31676, 31869, 31876, 32418

31898 (AD-A-204481/6/XAB) **Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report.** Mettlach, T.R.; Haney, R.L.; Garwood, R.W.; Ghan, S.J. Naval Postgraduate School, Monterey, CA (USA). 15 Feb 1987. 9p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Geophysical Research (Oceans), Vol. 92, No. C2, 1967-1974(15 Feb 1987).

A one-dimensional oceanic planetary boundary-layer model is used to investigate the response of the upper ocean to the atmospheric conditions predicted to develop following a hypothetical nuclear exchange. The ocean model is driven by the surface heat and momentum fluxes predicted by an atmospheric general circulation model following a summertime injection of 1.5 X 10^{14} g of smoke from postwar fires over Europe, Asia, and North America. Although the specific response of the upper ocean is highly dependent on the geographic location, the mid-latitude summertime mixed layer typically cools 3 to 5°C and deepens 25 m during the first 30 days following the smoke injection. Moreover, a large fraction of this response is found to take place during a short 2- to 3-day period of very intense winds and falling air temperatures, which occurs during the first week or two after the smoke injection.

31899 (LA-11419-MS) **Goals for limited strategic defenses.** Canavan, G.H. Los Alamos National Lab., NM (USA). May 1989. 39p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89012260/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report reviews the nature of near and mid-term accidental, third-country, and limited threats, discusses the technologies available to defend against them, and examines the development programs required. 22 refs.

31900 (LA-11538-MS) **Issues in the sequential deployment of strategic defenses.** Canavan, G.H. Los Alamos National Lab., NM (USA). May 1989. 23p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89012261/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report discusses the application of control theory to simplified but increasingly relevant approximations to stability models. The simplest example reduces to the straightforward application of familiar algebraic techniques, and the general solution then emerges as an extension of that example. That demonstrates both the power and the limitations of control theory, particularly the limitations on the class of problems to which it can be applied directly. 3 refs., 6 figs.

31901 (ORNL/TM-10921) **Pilot-scale testing of a fuel oil-explosives cofiring process for recovering energy from waste explosives: Final report.** Bradshaw, W.M. Oak Ridge National Lab., TN (USA). Aug 1988. 127p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. (AMXTH-TE-CR-88272). Order Number DE89013657/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The US Army generates and stores a significant quantity of explosives and explosive-related materials that do not meet specifications for their primary use. Current explosives disposal processes do not recover any resources from these materials. The heat of combustion of these materials is typically 9 to 15 kJ/g (4000 to 6500 Btu/lb), which is 21 to 33% of the high heating value of No. 2 fuel oil. One secondary use for explosives is to cofire them with other fuels to recover their energy content. Bench-scale testing has shown that cofiring is feasible and safe within certain guidelines. To further evaluate cofiring, a proof-of-principle test was conducted in a 300-kW (10^6 Btu/h) combustion chamber. The test program was discontinued before completion because of failures largely unrelated to the explosives contained in the fuel. This report presents the results of the proof-of-principle tests, as well as design and operational changes that would eliminate problems encountered during the course of the test program. It is clearly feasible to cofire explosives and fuel oil. However, more data are needed before the process can be tested in a production boiler, furnace, or incinerator. 20 refs., 14 figs., 9 tabs.

31902 (PB-89-859961/XAB) **Nuclear warfare: survival. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 225p. Available from NTISPC N01/MF N01.

Supersedes PB-88-858477.

This bibliography contains citations concerning various factors and systems relating to both military and civilian personnel and general survival in nuclear warfare. Vulnerability and security of people, material, and systems are considered as well as their survivability. A wide variety of studies and analyses, many of them based upon computerized simulations, are included. (This updated bibliography contains 404 citations, 58 of which are new entries to the previous edition.)

31903 (SAND-88-3341) **Did high-altitude EMP [electromagnetic pulse] cause the Hawaiian streetlight incident?.** Vittitoe, C.N. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 40p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89012258/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Studies of electromagnetic pulse (EMP) effects on civilian and military systems predict results ranging from severe destruction to no damage. Convincing analyses that support either extreme are rare. The Hawaiian streetlight incident associated with the Starfish nuclear burst is the most widely quoted observed damage. We review the streetlight characteristics and estimate the coupling between the Starfish EMP and a particular streetlight circuit identified as one of the few that failed. Evidence indicates that the damage was EMP-generated. The main contributing factors were the azimuthal angle of the circuit relative to the direction of EMP propagation, and the rapid rise of the EMP signal. The azimuthal angle provided coherent buildup of voltage as the EMP swept across the transmission line. The rapid rise allowed substantial excitation before the canceling effects of ground reflections limited the signals. Resulting voltages were at the threshold for causing the observed fuse damage and are consistent with this damage occurring in only some of the strings in the systems. 15 refs., 16 figs., 4 tabs.

4503 Explosion Detection

31904 (UCRL-21086-Vol.1) **Seismic coupling of nuclear explosions: Volume 1.** Larson, D.B. (ed.). Defense Advanced Research Projects Agency, Arlington, VA (USA). 1988. 282p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012557/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

The research reported in this volume was funded with DARPA Fiscal Year 1985 money originally intended to pay for the site geology containment studies by LLNL which were required in order to detonate a nuclear test in the Eleana shale at the Nevada Test Site (NTS). DARPA's motivation for encouraging such a test was to accumulate experience in testing, and in yield estimation by CORRTEX and by seismic means, in a material that was as similar as possible to that thought to exist at the Shagan test site in the USSR. In light of the Joint Verification Experiments (JVE) which will be carried out as this report is distributed, it does seem unfortunate that such a test was never carried out. As it happened, there was not sufficient interest in the project in 1986 to enable the full funding of the experiment. For this reason the money was diverted to a coordinated set of studies which were designed to improve our understanding of the overall problems of the seismic coupling of nuclear explosions. It is my feeling that there have been a number of important results emerging from this work, and I discuss some of them briefly. Individual papers were processed separately for the data base.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

Refer also to citation(s) 31512, 31528, 31898, 31920, 31928, 31968

31905 (CONF-870430–17) **The Argonne low level ^{14}C counting system.** Gray, J.; Rymas, S.J.; Studebaker, L.D.; Yule, H.P. Argonne National Lab., IL (USA). 1987. 13p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on methods and applications of radioanalytical chemistry; Kona, Hawaii, USA; 5-10 Apr 1987. Order Number DE89013625/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A low level $^{14}CO_2$ counting system is described. This system was used to process several thousand CO_2 samples derived from atmospheric collections at various altitudes. Special features include counter construction utilizing electrolytic copper and shielding with neutron moderating and absorbing paraffin containing sodium metaborate. The effect of steel shielding thickness is shown, and the anticoincidence counters are described. Purification of the CO_2 for proportional counting is discussed. 5 refs., 3 figs.

31906 (INIS-BR–1458, pp. 156) **Analysis of aerosol samples from local atmosphere in Mexico City.** Aldape, F. (Instituto Nacional de Investigaciones Nucleares, Mexico City); Maggi, R.; Jimenez, F. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

EARTH ATMOSPHERE/aerosols; EARTH ATMOSPHERE/mexico; EARTH ATMOSPHERE/pixe analysis; AEROSOLS; MEXICO; ELEMENT ABUNDANCE; MEV RANGE 01-10; PROTON BEAMS; VAN DE GRAAFF ACCELERATORS; VARIATIONS

31907 (K/D–5694) **A computer program for simulating the atmospheric dispersion of UF_6 and other reactive gases having positive, neutral, or negative buoyancy.** Bloom, S.G.; Just, R.A.; Williams, W.R. Oak Ridge Gaseous Diffusion Plant, TN (USA). Mar 1989. 234p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE89012734/JAW. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

This report describes a mathematical model which was developed to simulate the atmospheric dispersion of chemically reactive gases that may be neutrally buoyant, positively buoyant, or negatively buoyant with respect to the ambient air. Emphasis is on materials used at uranium enrichment facilities, particularly uranium hexafluoride and its hydrolysis products. The report discusses the mathematical principles of the model, the chemical and physical properties used in the model, the computer program which was developed to perform the calculations, and the iterative techniques used in the model. Descriptions of the computer program are given as appendices. 41 refs., 18 figs., 27 tabs.

31908 (NILU/OR–12/88) **Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds.** Hov, Oe. Norsk Inst. for Luftforskning, Lillestroem (Norway). Feb 1988. 39p. Order Number DE89766873/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Ozone (O/sub 3/) episodes in the atmospheric boundary layer over Europe are superimposed on slowly increasing background levels which probably is controlled by changes in the emissions of nitrogen oxides (NO/sub x/). Increase in the emission of NO/sub x/ in Europe and elsewhere in the northern hemisphere will contribute to a continued rise in free tropospheric O/sub 3/, while occurence of O/sub 3/episodes in the boundary layer may not change much. Nitrate due to NO/sub x/emissions contributes significantly to acid deposition in Europe and elsewhere and integrated over one year there is probably a nearly linear relationship between these changes. In clean air, decreased emissions of NO/sub x/is shown in model calculations to cause drop in the background concentration of O/sub 3/and OH, while H/sub 2/O/sub 2/increases. The gasphase conversion of SO/sub 2/and NO/sub x/by reaction with OH to sulphate and nitrate will become less efficient. The dark reaction converting NO/sub 2/to the NO/sub 3/radical and then to nitrate by reacting with O/sub 3/, would become slower, while the wet phase oxidation of SO/sub 2/to sulphate would become more efficient. The result is a more than proportional reduction in the nitrate formation could increase thus increasing the lifetime for S-compounds and decreasing the lifetime for NO/sub x/-compounds. A decrease in global NO/sub x/emissions will cause a drop in the tropospheric O/sub 3/-increase and reduce it's potential warming effect and can come about by reducing the burning of fossil fuels. Reducing NO/sub x/would also reduce tropospheric OH. With unchanged surface sources of CH/sub 4/, tropospheric CH/sub 4/would increase in concentration more than today, contributing more to the surface warming than 0.14 K in 50 years. The combustion of fossil fuels is an important source of CO/sub 2/and it would reduce both NO/sub x/and CO/sub 2/emissions. 42 refs.

31909 (RISO-M–2718) **Project WIND, phase IV, dispersion study. Aerial smoke plume observations and surface layer turbulence measurements. Part 1.** Mikkelsen, T.; Hansen, A.; Eckman, R.M.; Thykier-Nielsen, S. Risoe National Lab., Roskilde (Denmark). Jan 1989. 121p. Order Number DE89776150/JAW. Available from NTIS (US Sales Only), PC A06/MF A01;1.

The present data report is based on direct turbulence and diffusion measurements performed by Risoe National Laboratory during the AMADEUS smoke tests of Project Wind, Phase IV, which took place as a cooperative research-oriented field effort between the U.S. Army Atmospheric Sciences Laboratory (ASL) and the U.S. Department of Agriculture Forest Service (USDAFS) in the Meadow Brook Valley near Red Bluff, California, between 23 September and 7 October 1987. In particular, Risoe National Laboratory performed (1) direct measurements of the surface layer scaling parameters such as heat flux, shear stress, turbulence, and stability measurements at two characteristic locations in the Meadow Brook Valley floor and (2) concurrently obtained documentation of the plume and puff spread based on aerial photography. The present report provides time series plots of the 10-min averaged covariance matrix of u,v,w, and T from the two sonics together with prints of photos taken of the smoke/puff plumes from an aircraft in a form suitable for subsequent model simulation of individual dispersion scenarios. (author) 27 ills.

31910 (UCID–21633) **Simulations of cloud condensation droplet nucleation and growth.** Edwards, L.L. Lawrence Livermore National Lab., CA (USA). Mar 1989. 19p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89013378/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The CAMP (Cloud Atmospheric MicroPhysics code) is used to demonstrate the calculation of condensation growth on both fully soluble and insoluble but wettable distributions of aerosol particles. A "standard" atmosphere case is considered as well as cases with aerosol loadings that might be expected over large fires supposedly ignited by nuclear blasts. 16 refs., 13 figs.

31911 (UCRL–21003) **Applications of large-eddy simulation: Model comparison and calibration: Technical report B048682-1.** Ohmstede, W.D. Lawrence Livermore National Lab., CA (USA); Ohmstede (William D.), Las Cruces, NM (USA). Feb 1989. 31p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012605/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this report is to describe progress made in the provision of continuing scientific and technical support to the meteorological modeling program at LLNL. The contracted Scope of Work consisted of two tasks: Task (1) Test and evaluate the calibration and application of the Brost large-eddy simulation (BLES) model for a variety of neutral boundary layer simulations. Task (2) Assist with implemention of the Mesoscale Forecast Model for the High Energy Laser Test Facility (HELSTF) as needed. The report is divided into two parts corresponding with the two tasks. Part I describes the continued applications of large-eddy simulation (LES), and Part II briefly summarizes the effort made concerning Task 2. 11 refs., 6 figs.

31912 (UCRL–100817) **Simplified climate models: Rationale and design.** Ghan, S.J. Lawrence Livermore National Lab., CA (USA). Apr 1989. 35p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-8904217–1: Short course on development of zonally-averaged models of the atmosphere, Louvain, Belgium, 17 Apr - 15 may 1989). Order Number DE89012291/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In order to address a wide range of climate issues involving climate components with a diversity of time scales and spatial scales, a hierarchy of climate models has been developed over the past two decades. This survey paper discusses the rationale for selecting relatively simple climate models over more comprehensive models for certain applications. The hierarchy of simple climate models is reviewed, beginning with the educational role played by zero-dimensional planetary energy balance models. One-dimensional radiative-convective and two-dimensional (latitude-longitude) energy balance models are recommended for many applications. Two-dimensional (latitude-altitude) dynamical models are suggested for climate issues in which the hydrological cycle plays an important role and practical considerations preclude the application of comprehensive general circulation models. 57 refs., 7 figs.

5002 Chemicals Monitoring and Transport

Refer also to citation(s) 30304, 30799, 30800, 30806, 30810, 30978, 31041, 31114, 31125, 31167, 31411, 31986, 32041, 32042, 32043, 32044, 32045, 32049, 32400

31913 (AD-A–204237/2/XAB) **Barrierless ultrasonic air cleaner. Final report.** Thomas, B.J.; Taylor, S.R.; Treuhaft, M.B. Taylor (S.R.) and Associates, Bartlesville, OK (USA). Jan 1988. 45p. Available from NTIS, PC A03/MF A01.

This report describes an experimental program (SBIR Phase I) to demonstrate the technical feasibility of using an ultrasonic standing-wave field to promote coalescence of airborne dusts in order to improve the separation efficiency of typical inertial separators such as current precleaners. Major project tasks included assembly of an ultrasonic coalescence array; measurement of the dust mass passing through an inertial separator as a function of upstream dust concentration, airflow rate, and ultrasonic power level; and calculation of the improvement in separator efficiency as a function of coalescence. The results clearly demonstrate the technical feasibility of using an ultrasonic standing wave field to alter the particle size distribution of airborne dust in order to improve the performance of existing inertial separators, such as those used for precleaner in state-of-the-art air cleaner systems. Importantly, there is no pressure drop across the standing wave field and hence the problems typically associated with barrier filter loading can be avoided.

31914 (BCMEP–8801) **Woodwaste incineration and air quality in Williams Lake.** Bhattacharyya, K.K. British Columbia Ministry of Environment and Parks, Victoria, BC (Canada). 1988. 95p. (MICROLOG–88-05577). Available from British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Large volumes of woodwaste disposal by incineration in a number of wigwam burners are contributing to pollution problems in Williams Lake, British Columbia. In 1985, the latest year for which data are available, total woodwaste production was about 800 million bd ft equivalent; only about 14% of this was used for energy recovery. In addition, about 66,000 m/sup 3/of waste was sent to landfills after open burning. The characteristics of the local woodwaste are summarized, and available conversion technologies and the potential application of their products are reviewed. These include direct combustion, pyrolysis, gasification, liquefaction, and densification, for use in power generation, cogeneration, and the manufacture of saleable products. Environmental and legal aspects of woodwaste utilization are also outlined. Finally, options for reducing pollution from existing burners are reviewed. One option is the upgrading of existing burners; however, it is noted that there are inherent deficiencies in the wigwam burner design itself that preclude effective woodwaste combustion. Another option is to provide a centralized burner to replace all existing burners. There is also good potential for utilizing a significant quantity of woodwaste at individual mills to generate process heat. As a long term option, power generation has potential provided that there is an assured woodwaste supply, that the excess electricity can be sold, and that a reasonable rate of return on investment can be provided. A cogeneration facility appears even more attractive because of its energy efficiency. A study is also made of manufacturing densified fuel pellets; the main constraint is transportation costs. 9 figs., 3 tabs.

31915 (BCMEP–8808) **An air management strategy for Williams Lake.** Wilson, R.G. British Columbia Ministry of Environment and Parks, Victoria, BC (Canada). 1988. V (MICROLOG–88-05567). Available from British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

An investigation was conducted into alternatives for controlling emissions from woodwaste burners in Williams Lake, British Columbia. The investigation examined those measures which could produce acceptable air quality, while focusing on opportunities to reduce the number of burners and the quantity of wood burned. This report provides an overview of the investigation, and specifically concentrates on potential solutions and related policy issues. One option was to reduce the number of burners, either by eliminating some of the existing ones, or replacing all burners by a centrally located burner equipped with modern emission controls (to be supplied cooperatively with woodwaste from former users of the old burners). Another option was to increase the use of woodwaste as an energy source in the local lumber mills. Long term options are to use woodwaste to generate electricity, and to use woodwaste as raw material for manufacturing densified wood pellets which could be sold as fuel. It was recommended that the power generation option should be pursued vigorously; it is felt that this option is economically attractive and has considerable potential for success if the existing electricity purchase policies of the provincial hydro utility can be appropriately modified.

31916 (BNL–42277) **Environmental Chemistry Division: Annual report, 1988.** Brookhaven National Lab., Upton, NY (USA). Jan 1989. 145p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89013212/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The research activities making up the programs in the Environmental Chemistry Division of the Department of Applied Science are presented. Some of the more significant accomplishments during 1988 are described and plans for 1989 are discussed briefly. Publications for the period are listed and abstracts are provided. Research objectives and principal investigators are given for each of the active programs. A list of personnel and collaborators during the past year is presented. The support distribution for FY 1989 is approximately 85% from the Department of Energy (65% Office of Health and Environmental Research), and 15% other agencies (principally from the Electric Power Research Institute). 36 refs.

31917 (CANMET–8711) **Derivation of the brake-specific ventilation equation and on operating load factor expression relevant to the use of diesel machinery underground.** Dainty, E.D. Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). 1987. 10p. (MICROLOG–88-05516). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Analysis is presented which suggests that the measurement of CO/sub 2/in the dieselized environment of concern, along with knowledge of the ventilation rate in a given work area, irrespective of numbers and type of machines, will permit the ready determination of: actual overall fuel consumption, actual brake-specific ventilation, operating brake horsepower and overall operating load factor. This latter factor can be thought of as a relative index of productivity, as well as a means of establishing ventilation reduction factors for certification-determined maximum ventilation requirements for a given operating situation. 1 fig.

31918 (CONF-881245–2) **The role of regional activity forecasts in projecting emission trends of acid deposition precursors.** Bando, A.; Hanson, D.A.; Streets, D.G. Argonne National Lab., IL (USA). 1988. 23p. Sponsored by DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 2. joint conference on integrating data for decisionmaking; Washington, D.C., USA; 12-14 Dec 1988. Order Number DE89013181/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Under the auspices of the National Acid Precipitation Assessment Program, Argonne National Laboratory is currently integrating a set of emissions models into a consistent system composed of coordinated modules. The integrated model is being designed to provide emissions forecasts to the year 2030, by sector and by region. This paper provides an overview of this integrated model, briefly describes the regional forecasts underlying the sectoral emissions projections, and includes a short discussion of the methods used to determine the secondary impacts of policies aimed at controlling acid deposition. Some standard economic principles are reviewed as a guide for policy evaluation. 12 refs., 4 figs., 3 tabs.

31919 (CONF-890521–10) **The potential of continuous emission monitoring of hazardous waste incinerators using Fourier transform infrared spectroscopy.** Demirgian, J.C.; Erickson, M.D. Argonne National Lab., IL (USA). 1989. 7p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 8. international conference on thermal destruction of hazardous, radioactive, infectious and mixed wastes; Knoxville, Tennessee, USA; 1-5 May 1989. Order Number DE89013172/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The testing of stack gas from hazardous waste incinerators is required during trial burns and in on going process monitoring. This paper discusses the use of Fourier transform infrared spectroscopy (FTIR) as a continuous emission monitor (CEM) for stack gas. Currently, the principal organic hazardous constituent (POHC) in stack gas is not monitored continuously. During a trial burn, the POHC from the waste, often carbon tetrachloride or chloroform, is sampled on sorbent cartridges by a volatile organic sampling train (VOST) followed by lab analysis using thermal desorption GC/MS. Results are typically available in a few weeks. Hence, the demonstration of 99.99% destruction and removal efficiency (DRE) cannot be done in real time. A CEM would provide instant feedback when upsets occur and allow corrective action to be initiated immediately. This should result in reduced public concern about hazardous waste incineration, quicker approval of incineration sites, and rapid growth of total incineration capacity. Due to advances in instrumentation, cell design, and software, FTIR has great potential for use as a CEM of vapor phase components. Although infrared spectroscopy was first used over 20 years ago to identify vapor phase components, it is only now, as a result of these advances, that vapor samples can be characterized qualitatively and quantitatively for multiple components at ppB levels. FTIR also has a large dynamic measurement range, which is important, since upsets may introduce sudden large increases in POHCs. 11 refs., 3 tabs.

31920 (CONF-890692–6) **Criteria for selecting a CO_2/climate change region of study.** Edmonds, J.; Cushman, R.; Easterling, W.; Malone, T.; Rosenberg, N.; Scott, M.; Stokes, G. Oak Ridge National Lab., TN (USA). 1989. 15p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400;AC06-76RL01830. From 82. Air and Waste Management Association annual meeting and exhibition; Anaheim, California, USA; 25-30 Jun 1989. Order Number DE89011233/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

One of the most important research issues active today is the greenhouse issue. Progress has been made in exploring the relationship between human activities and the accumulation of CO_2 and other radiatively important gases in the atmosphere. While significant research remains in refining our understanding of the timing of possible CO_2/climate change, the examination of the nature and magnitude of consequences of CO_2/climate change remains in a relatively early stage of development. While the accumulation of greenhouse gases in the atmosphere may be a global problem, the consequences of CO_2/climate change will be experienced regionally. It is therefore critical that methods be developed to address the regional examination of CO_2/climate change. An analytical framework is described and a "cookie cutter" technique is utilized to deal with multiple resource sectors in selecting a Region of Study. The result leads to the selection of the four midwestern states of Kansas, Nebraska, Iowa, and Missouri. The role of information systems, uncertainty analysis, and knowledge transfer is discussed. 19 refs., 2 figs.

31921 (CONF-890692–9) **Adequacy of forestry data in assessing the impact of ozone: A national perspective.** Shriner, D.S.; Carpenter, D.E. Oak Ridge National Lab., TN (USA). 1989. 15p. Sponsored by Environmental Protection Agency. DOE Contract AC05-84OR21400. From 82. Air and Waste Management Association annual meeting and exhibition; Anaheim, California, USA; 25-30 Jun 1989. Order Number DE89012359/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Regional-scale assessment of the effects of ozone on forest ecosystems involves a diffuse array of sources distributed across tens of thousands of square kilometers. Exposure characteristics have short-term dynamics (hours or days), but effects may be manifest only after years of exposure. Discussion of the adequacy of forestry data for assessing the impact of ozone on forests from the national perspective requires first a discussion of the process by which such an assessment might be done, and secondly, discussion of the other types of data necessary to permit differentiation of forest impacts. This paper addresses a variety of approaches to assessment of forest impacts, discusses the basic data requirements necessary for an assessment of ozone impacts on forests, and provides an assessment of data availability on a national scale. 24 refs., 4 figs.

31922 (CONF-890692–11) **Illustrative emission reduction scenarios.** Placet, M. Argonne National Lab., Washington, DC (USA). 1989. 14p. Sponsored by DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From 82. Air and Waste Management Association annual meeting and exhibition; Anaheim, California, USA; 25-30 Jun 1989. Order Number DE89013302/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The National Acid Precipitation Assessment Program (NAPAP) will conclude in 1990 with the publication and public review of a final comprehensive assessment. The assessment will include an analysis of the state of knowledge of acidic deposition and its current effects, which will be documented in a series of state-of-science/technology reports. Moreover, NAPAP will estimate what future changes in patterns and magnitudes of acidic deposition and its effects would occur under two circumstances: (1) without further government initiatives to reduce acidic deposition, and (2) with strategies aimed at reducing emissions of acidic deposition precursors. The following sections of this paper describe the manner in which NAPAP makes projections of future emissions, NAPAP's progress in developing both reference and emission-reduction scenarios, and the manner in which those emission projection results will be used in the Integrated Assessment.

31923 (CU/KC–8809) **The present and potential effects of acidic and acidifying air pollutants on Alberta's environment. Summary report.** Calgary Univ., AB (Canada). Kananaskis Centre for Environmental Research. 1988. 97p. (MICROLOG–89-00374). Available from Alberta Legislative Library, 216 Legislature Bldg., Edmonton, AB, Canada T5K 2B6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A program of studies was conducted in Alberta with the objectives of: determining whether there are at present any observed or measurable adverse effects of acidic or acidifying pollutants on vegetation, soils, and surface waters; and if such effects were not observed or measured, determining when, where, and under what circumstances they could occur in Alberta. This report summarizes the results of those studies, involving a literature review, characterization of background air quality, comprehensive characterization of an environment within the province influenced by various pollutant sources, preparation of an emission inventory of the oxides of sulfur and nitrogen, and development of regional-scale air quality predictions and application of such data toward regional-scale environmental effects assessment. The air monitoring program generated an extensive data base, and permitted assignment of pollutants to probable sources, provided data for validation of pollution dispersion models, and permitted a critical test of statistical

techniques used in treatment of air monitoring data. It was seen that all data were best fit by a Weibull distribution. Short- and long-term models were developed and evaluated, and suitable models for pollutant dispersion were selected in the most conservative fashion possible. With few exceptions, the models demonstrated no impacts on crops, soils, or surface waters in Alberta. However, large increases in mean deposition levels could impact alfalfa and similarly susceptible vegetation, particularly in areas that also experience high ozone concentrations. Such increases could acidify soils and surface waters in a few susceptible areas. 27 figs., 29 tabs.

31924 (DOE/ER/60255–5) **The effects of atmospheric CO_2 on insect herbivores and their hosts plants: Progress report.** Lincoln, D.E. South Carolina Univ., Columbia, SC (USA). Dept. of Biological Sciences. Apr 1989. 77p. Sponsored by DOE Energy Research. DOE Contract FG09-84ER60255. Order Number DE89011830/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The overall goal of the research program is to determine how plant/herbivore interactions change with increasing atmospheric CO_2 concentration and how these changes affect community structure and functioning. Five specific objectives have been developed to approach these goals over the grant period. These objectives are to determine: (1) if specialist feeding herbivores respond to host plant CO_2 enrichment in the same manner as generalist feeders, (2) if the impact of defoliation is lessened under enriched CO_2conditions, (3) the biochemical basis for the altered nutritional value of leaves resulting from elevated CO_2, (4) the demographic and consumption responses of an herbivore to CO_2 regimes, and (5) whether plants with the C_4 photosynthetic pathway will also have altered relationships with herbivores. Significant progress has been made on three of these goals. Manuscripts are appended. A revised study plan to complete the remaining objectives is appended.

31925 (ECN–215) **The determination of acid-deposition-related compounds in the lower atmosphere.** Keuken, M.P. Netherlands Energy Research Foundation, Petten (Netherlands); Vrije Univ., Amsterdam (Netherlands). Apr 1989. 167p. Order Number DE89766237/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG PETTEN, Netherlands.

This report deals with the analytical chemical aspects of research related to air pollution caused by the emisssions of sulfur dioxide (SO/sub 2/), nitrogen oxides (NO/sub x/) and ammonia (NH/sub 3/). Generally, this phenomenon is known as 'acid rain' and 'acid deposition'. The main subject of this work is to describe the development of instrumentation and analytical methods for the determination of acid-deposition-related components in ambient air. The conclusions of the research described in this report can be summarized as follows: in the case of wet deposition the sampling problems are practically eliminated by the introduction of wet-only samplers. analytical procedures for the analysis of precipitation samples are adequate within a reproducibility of 5-10% for the relevant acid-deposition-related components. As a consequence of the large sample series involved, present analytical research is directed towards automation and multi-component detection; in the case of dew and occult deposition by mist droplets, the main problem is the development of sampling equipment. Analytical problems compared to the analysis of precipitation samples are the limited amount of sample volumes and the presence of unstable components, such as sulfite, HMSA, H/sub 2/O/sub 2/and C/sub 1/-C/sub 2/aldehydes and organic acids. Present research is directed to methods, which require small sample volumes and multi-component detection, such as flow injection analysis and HPLC; in the case of dry deposition by gases (e.g., SO/sub 2/, HCl, NH/sub 3/, HNO/sub 3/) and aerosols (e.g., NH/sub 4/NO/sub 3/, H/sub 2/SO/sub 4/and (NH/sub 4/)/sub 2/SO/sub 4/) the main problem is the measurement of their dry deposition velocities and the lack of data concerning spatial and temporal variations of ambient air concentrations. The automated systems described may contribute to solve these problems in the future.

31926 (IVL-B–916) **Emission of carbon dioxide from anthropogenic sources in Sweden.** Calander, K.; Gustavsson, K.; Grennfelt, P.; Loevblad, G. Swedish Environmental Research Inst., Goeteborg (Sweden). Dec 1988. 18p. (In Swedish). Order Number DE89766909/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

IVL has calculated the anthropogenic emissions of carbon dioxide in Sweden from 1973 to 1987. The report includes a scenario for the years 1995 and 2000. The emissions 1987 was 16.6 million tons CO/sub 2/(as C) or 60.8 million tons CO/sub 2/(as CO/sub 2/). (authors).

31927 (KCP–613-4101) **Annual site environmental report for calendar year 1988, United States Department of Energy, Kansas City Plant, Kansas City, Missouri.** Heacock, B.D. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. May 1989. 136p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE89013343/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

Environmental monitoring for significant nonradioactive pollutants was conducted to allow evaluation of effluents effects on the environs of the federal complex. Monitoring for radioactive pollutants was not conducted because no processes exist that have a radioactive effluent to the environment. The nonradioactive monitoring data were compared to appropriate standards and guidelines. Results of ambient air and surface water analyses are well below standards and demonstrated no discernible adverse effects on air and water quality from plant discharges. On-site groundwater monitoring, ongoing since CY1984, continued in 1988. Data from these wells were obtained to characterize the site to meet hazardous waste regulations for land disposal facilities. A groundwater treatment plant began operation in 1988 to remove solvent contamination in the area of the underground tank farm. A site characterization study and a DOE Albuquerque Operations (DOE/AL) Comprehensive Environmental Restoration Program (CERP) were merged in CY1988 to form the Environmental Restoration (ER) Program, which continued to identify other areas of environmental concern in 1988. The plant's National Pollutant Discharge Elimination System permit required effluent monitoring of discharges entering Indian Creek and Blue River. 27 refs., 8 figs., 6 tabs.

31928 (KFK–4511) **Analysis of dispersion and deposition of acidifying and phytotoxic air pollutants.** Braeutigam, K.R.; Halbritter, G.; Brandl, V.; Findling, B.; Fuerniss, B.; Kupsch, C.; Sardemann, G.; Schuler, A.; Schulz, V.; Wiesmann, F.J. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse. Feb 1989. 522p. (In German). Order Number DE89774668/JAW. Available from NTIS (US Sales Only), PC A22/MF A01;1.

Concentration and deposition of sulfur and nitrogen compounds in the FRG mainly result from own emissions and those of the neighbouring countries. For these countries the regional distribution of emissions is established for different sectors and emission heights for 1982. For some of these countries the future development is estimated up to the year 1995. Calculations of long-range transport of sulfur compounds are performed with the trajectory-model MESOS for the year 1982. The regional distribution of ground-level concentration of SO/sub 2/and SO/sub 4/and of total sulfur-deposition is calculated for the area of the FRG. There is good agreement between calculated and measured values for SO/sub 2/ground-level concentration. The planned national and international emission reduction measures will considerably lessen ground-level concentration and deposition values within the FRG. The fact, that in the FRG nitrogen oxide emissions will not be reduced to the same extent as sulfur oxide emissions is due to continuous high releases from transport because emission reductions will largely be offset by higher traffic density and more driven kilometers. The transport sector is not only the main emittor of nitrogen oxides, but also of hydrocarbons. The state of knowledge on air chemistry of sulfur and nitrogen compounds during the gas and liquid phases and the mechanisms leading to anthropogenic ozone production are analysed in detail.

31929 (LBL–24212) **Environmental research program: FY 1987, annual report.** Lawrence Berkeley Lab., CA (USA). Mar 1988. 42p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE89013366/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This multidisciplinary research program includes fundamental and applied research in physics, chemistry, engineering, and biology, as

well as research on the development of advanced methods of measurement and analysis. The Program's Annual Report contains summaries of research performed during FY 1987 in the areas of atmospheric aerosols, flue gas chemistry, combustion, membrane bioenergetics, and analytical chemistry. The main research interests of the Atmospheric Aerosol Research group concern the chemical and physical processes that occur in haze, clouds, and fogs. For their studies, the group is developing novel analytical and research methods for characterizing aerosol species. Aerosol research is performed in the laboratory and in the field. Studies of smoke emissions from fires and their possible effects on climatic change, especially as related to nuclear winter, are an example of the collaboration between the Atmospheric Aerosol Research and Combustion Research Groups.

31930 (LBL–25348-Rev.) **Real-time measurement of the size fractionation of aerosol black carbon during the South Coast Air Quality Study, June 13–September 4, 1987, Claremont College, Claremont, California: Final report: Revision.** Hansen, A.D.A.; Novakov, T. Lawrence Berkeley Lab., CA (USA). Nov 1988. 53p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE89013364/JAW. Available from NTIS, PC A04/MF A01 - OSTI.

During the periods June 13 to July 28 and August 17 to September 4, 1987, the Atmospheric Aerosol Group of Lawrence Berkeley Laboratory participated in the South Coast Air Quality Study conducted at Claremont College, Claremont, California. We used a multi-channel aethalometer preceded by size-selective inlets to determine the concentration of aerosol black carbon in two size ranges in real time. In this report we present our results from this study in the form of one-hour and periodic (typically 12-hour) averages of carbon concentrations for the aerosol in size range fractions having aerodynamic diameters smaller than approximately 1.0 um and 0.3 um. The concentration results show daily mean values generally ranging from 1 to 4 ug/m^3, with a diurnal cycle showing little variation during nighttime hours and a pronounced peak between the hours of 8 a.m. and 10 a.m. The results for the size fractionation show that the great majority of the aerosol black carbon was found in the size range smaller than 0.3 um: however, this fraction showed a systematic diurnal variation with a decline in the morning and the mid-day periods. 13 refs., 26 figs., 9 tabs.

31931 (LBL–26584) **Environmental Research Program: FY 1988 annual report.** Lawrence Berkeley Lab., CA (USA). Mar 1989. 22p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE89013355/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The principal objective of the Environmental Research Program is to understand the formation, transformation, transport, and effects of energy-related pollutants on the environment, and how these are influenced by energy generation and emission control technology. The multidisciplinary research program includes fundamental and applied research in physics, chemistry, engineering, and biology, as well as research on the development of advanced methods of measurement and analysis. The Program's Annual Report contains summaries of research performed during FY 1988 in the areas of atmospheric aerosols, flue gas chemistry, combustion, membrane bioenergetics and analytical chemistry. The main research interests of the Atmospheric Aerosol Research Group concern the chemical and physical processes that occur in haze, clouds, and fogs, and development of novel methods for individual particle characterization. The Flue Gas Chemistry Research group is engaged in research whose aim is to help develop new processes for simultaneous SO_2 and NO_xremoval. The Combustion Research Group studies complex combustion processes by acquiring a fundamental understanding of the physical and chemical processes that determine the combustion efficiency, formation, and emissions of species from these processes. The Membrane Bioenergetics Group studies the effects of strongly chemically reactive compounds generated within cells. The main emphases in Analytical Chemistry have continued to be in the area of impacts and mass extinctions.

31932 (LBL–26890) **Real-time measurement of the size fractionation of aerosol black carbon during the Southern California Air Quality Study, June 13–September 4, 1987, Claremont College, California.** Hansen, A.D.A.; Novakov, T. Lawrence Berkeley Lab., CA (USA). Mar 1989. 16p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890692–7: 82. Air and Waste Management Association annual meeting and exhibition, Anaheim, California, USA, 25-30 Jun 1989). Order Number DE89010432/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the periods June 13 to July 28 and August 17 to September 4, 1987, the Atmospheric Aerosol Group of Lawrence Berkeley Laboratory participated in the South Coast Air Quality Study conducted at Claremont College, Claremont, California. We used a multi-channel aethalometer preceded by size-selective inlets to determine the concentration of aerosol black carbon in two size ranges in real time. We present our results from this study in the form of one-hour averages of carbon concentrations for the aerosol in size range fractions having aerodynamic diameters smaller than approximately 1.0 μm and 0.3 μm. The concentration results show daily mean values generally ranging from 1 to 4 μg/m^3, with a diurnal cycle showing little variation during nighttime hours and a pronounced peak between the hours of 8 and 10 a.m. The results for the size fractionation show that the great majority of the aerosol black carbon was found in the size range smaller than 0.3 μm: however, this fraction showed a systematic diurnal variation with a decline in the morning and the mid-day periods. 13 refs., 7 figs.

31933 (LBL–27011) **The LBL/AGMEF/JSU El Yunque Environmental Research Initiative.** Dod, R.L.; Diaz, F.; Feliu, L.; Parker, C.D. Lawrence Berkeley Lab., CA (USA). Mar 1989. 19p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE89012769/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The LBL/AGMEF/JSU Environmental Research Initiative has had several noteworthy successes. Faculty and student development is apparent. A research project involving atmospheric aerosol sampling was established at Universidad Metropolitana under Prof. Fernando Diaz. A National Science Foundation grant received to expand upon that project. Review of analyses carried out since 1986 supports the original view that El Yunque peak on the eastern end of Puerto Rico offers a unique site to study atmospheric processes relevant to current national and international concerns regarding global climate modification. Based on this review, a Puerto Rico El Yunque Intensive Summer Research Campaign is proposed. 6 refs.

31934 (OE–8803) **Ambient air quality during the pre start up period of the Victoria Hospital energy-from-waste plant.** Ontario Ministry of the Environment, Toronto, ON (Canada). 1988. 28p. (MICROLOG–89-01555). Available from Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In May 1986, approximately one year prior to the scheduled start up of the energy-from-waste plant of the Victoria Hospital in London (Ontario), ambient air quality monitoring was commenced at four fixed sites. The monitoring program consisted of continuous sulphur dioxide monitoring at three sites, and dustfall and total suspended particulate sampling at four sites. The dustfall and total particulate samples were analyzed for a number of metal constituents. The monitoring program demonstrated that levels of dustfall, total suspended particulates and sulfur dioxide were low in the vicinity of the facility. In addition, the constituents analyzed in the total suspended particulate samples were mostly found at very low levels, with many results being below the detection level of the analytical method used. Those that appear in the highest concentrations are total carbon, sulfate, and nitrates. 1 fig., 9 tabs.

31935 (OME/APIOS–012-88) **Acid precipitation in Ontario study, annual program report, 1987/1988.** Ontario Ministry of the Environment, Toronto, ON (Canada). Acid Precipitation in Ontario Study. [1989]. 83p. (MICROLOG–89-01646). Available from Coordination Office, 40 St. Clair Avenue West, 7th Floor, Toronto, ON, Canada M4V 1M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Acidic Precipitation in Ontario Study (APIOS) was established in 1979 to investigate the causes and effects of the long-range transport of air pollutants. The program is organized into

seven work groups: emissions and atmospheric processes, aquatic effects, terrestrial effects, biogeochemical effects, legal initiatives, environmental management and economics, and communications. This report summarizes the year's activities of APIOS and includes synopses of the major projects of the various work groups. An extensive listing of APIOS-related technical reports and submissions, publications, and papers is also included. 27 figs., 3 tabs.

31936 (ORNL–6492) **Countermeasures to hazardous chemicals.** Holmes, J.M.; Byers, C.H. Oak Ridge National Lab., TN (USA). Apr 1989. 327p. DOE Contract AC05-84OR21400. Order Number DE89012900/JAW. Available from NTIS, PC A16/MF A01 - OSTI; GPO Dep.

Recent major incidents involving the airborne release of hazardous chemicals have led to this study of effective strategies must be developed to prevent and to deal with emergencies. The comprehensive study of FEMA and the various other entities required that the project be divided into three tasks. These included Task 1 (the nature of the threat from incidents involving airborne hazardous chemicals is described. Based on available databases, a new methodology for ranking chemical hazards is proposed and tested); Task 2 (Existing responsibilities of federal, state, and local agencies, as well as the part played by the private sector, have been surveyed. Legislation at all levels of government are reviewed and in light of this analysis, the role of FEMA is examined. Institutional options to new and existing approaches for reducing risk are reevaluated, and recommendations are made for these approaches); and Task 3 (Technical options are discussed in light of the most hazardous situations, and recommendations are made for action or research where needed. Emphasis is laid on new and emerging technologies in the area). Recommendations are offered regarding actions which would improve preparation, training, mitigation, and response on the part of FEMA to the release of hazardous chemicals. 180 refs., 13 figs., 34 tabs.

31937 (ORNL–6521) **Environmental Sciences Division annual progress report for period ending September 30, 1988.** Oak Ridge National Lab., TN (USA). Apr 1989. 274p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89012929/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3219.

This progress report summarizes the research and development activities conducted in the Environmental Sciences Division of Oak Ridge National Laboratory during the period October 1, 1987, through September 30, 1988. The report is structured to provide descriptions of current activities and accomplishments in each of the Division's major organizational units. Following the accounts of section activities and program activities is a section devoted to lists of information necessary to convey the scope of the work in the Division.

31938 (PB–89-159024/XAB) **Validation testing of new mechanisms with outdoor chamber data.** North Carolina Univ., Chapel Hill, NC (USA). School of Public Health. Jan 1989. 648p. Available from NTIS, PC EE99/MF E99.

Set includes PB–89-159032 through PB–89-159065.

A separate abstract is included for each of the 4 volumes of this set.

31939 (PB–89-159032/XAB) **Validation testing of new mechanisms with outdoor chamber data. Volume 1: comparison of CB4 and CAL mechanisms. Final report, April 1986-September 1988.** Jeffries, H.E.; Sexton, K.G.; Arnold, J.R.; Li, J.L. North Carolina Univ., Chapel Hill, NC (USA). School of Public Health. Jan 1989. 298p. Available from NTIS, PC A13/MF A01.

See also Volume 4, PB–89-159065. Also available in set of 4 reports PC E99, PB–89-159024.

The UNC smog chamber data base was used to compare the performance of two state-of-the-science photochemical mechanisms: The Carbon Bond Four Mechanism (CB4) and the Carter, Atkinson, Lurmann Mechanism (CAL). Although the mechanisms behaved differently, both mechanisms showed good agreement with ozone and oxides of nitrogen chamber data. The agreement for other products such as formaldehyde and peroxyacetyl nitrate were not as good. Neither mechanism, however, was overall superior to the other in fitting chamber data. The two mechanisms predicted very similar VOC control requirements for the standard SIP-type cases. In SIP-like sensitivity analyses, CB4 was more sensitive to decreasing hydrocarbon and ozone aloft and to decreasing the temperature, giving somewhat lower control requirements than CAL at the extreme conditions. Although problems remain in the performance of both mechanisms, the authors do not believe that it is possible to choose between them on the basis of performance in either fitting chamber data or in predicting control calculations.

31940 (PB–89-159040/XAB) **Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988.** Jeffries, H.E.; Sexton, K.G.; Arnold, J.R. North Carolina Univ., Chapel Hill, NC (USA). School of Public Health. Jan 1989. 103p. Available from NTIS, PC A06/MF A01.

See also Volume 1, PB–89-159032 and Volume 3, PB–89-159057; Also available in set of 4 reports PC E99, PB–89-159024.

Ambient hydrocarbon data were analyzed to derive hydrocarbon speciation for use with the Carbon Bond Four (CB4) and the Carter, Atkinson, Lurmann (CAL) mechanisms. A total of 66 city-years of detailed surface-layer hydrocarbon data (comprising 773 individual analyses) was available. A total of 56 hydrocarbon samples collected aloft was also added to the data base. These data were speciated into the carbon fractions for hydrocarbon species in the CB4 and CAL mechanisms. Fractions for each mechanism are reported for each city-year, for five clusters of city years with similar internal composition, and for the total. The five clusters were determined using two forms of cluster analysis. Multiple regression was also used to confirm the overall average carbon fractions. Four analyses of automobile exhaust from the UNC autoexhaust smog-chamber study were also speciated. Recommendations for the default carbon fractions for OZIPM4 are given. Selected simulations for both mechanisms are used to demonstrate the effects of HC composition on ozone predictions.

31941 (PB–89-159057/XAB) **Validation testing of new mechanisms with outdoor chamber data. Volume 3: calculation of photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988.** Jeffries, H.E.; Sexton, K.G.; Arnold, J.R.; Kale, T.L. North Carolina Univ., Chapel Hill, NC (USA). School of Public Health. Jan 1989. 105p. Available from NTIS, PC A06/MF A01.

See also Volume 2, PB–89-159040 and Volume 4, PB–89-159065; Also available in set of 4 reports PC E99, PB–89-159024.

A new model is described for computing in-chamber actinic flux using site specific conditions that include time of day, air pressure, total column ozone, total column water vapor, relative humidity, aerosol type, aerosol optical density at 500 nm, and the spectral albedo of the aerosol. Included in this model are a highly accurate solar-coordinate model, two broad band models for predicting the Total Solar Radiation (TSR) and Eppley Ultraviolet Radiometer irradiances, a TFE film-transmission model, a total-chamber-transmission model, a reflective floor model, and a treatment for clouds. This model runs on MS/PC-DOS type machines. A description of how these models were used to compute the in-chamber actinic flux every 16-minutes for every day in the UNC data base is given. A description is also given of how these new actinic fluxes were used with kinetic data on species absorption cross sections and quantum yields to compute the photolysis rates of 20 reactions. A separate column contains the appendices for this document.

31942 (PB–89-159065/XAB) **Validation testing of new mechanisms with outdoor chamber data. Volume 4: appendixes to photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988.** Jeffries, H.E.; Sexton, K.G.; Arnold, J.R.; Kale, T.L. North Carolina Univ., Chapel Hill, NC (USA). School of Public Health. Jan 1989. 142p. Available from NTIS, PC A07/MF A01.

See also Volume 3, PB–89-159057; Also available in set of 4 reports PC E99, PB–89-159024.

This volume contains appendixes related to the computation of photolytic rates for the UNC chamber. The first appendix is the data base of climate and solar-radiation variables needed by the models, including time of day, air pressure, total-column ozone, total-column

water vapor, relative humidity, aerosol type, aerosol optical density at 500 nm, and the spectral albedo of the aerosol. The second appendix gives plots of broad band model predictions by the models compared with observed TSR and UV irradiance data for each day in the UNC data base, and includes selected examples of plots of the predicted NO_2 and HCHO-to-radicals photolysis-rates inside the chamber. The third appendix lists the molecular absorption cross sections and reaction quantum yields used in the photolysis rate calculations. The final appendix includes listings of the computer code for all models and sub-models. These models run on MS/PC-DOS type machines and are available on diskettes from the authors for distribution costs. The in-chamber photolysis rates for twenty species, computed every 16 minutes for each day in the UNC data base are also available on diskettes for distribution costs.

31943 (PB–89-161251/XAB) **Health-hazard evaluation determination report No. 75-87-280, Kawecki Berylco Industries, Inc., Reading, PA.** Chrostek, W.J.; Rostand, R.E. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Apr 1976. 25p. (HHE–75-087-280). Available from NTIS, PC A03/MF A01.

See also PB–83-133397.

A health-hazard evaluation investigation was conducted by NIOSH on August 19-22, 28-29, and October 30, 1975, at the Kawecki Berylco Industries, Inc., in Reading, Pa., a facility engaged in the manufacturing of beryllium alloy tools, wire, rods, and strips. The survey concerned exposure to hazardous concentrations of beryllium and development of beryllium lung disease. Environmental sampling revealed that employees in the foundry, arc, scrap remelt, calcine, Detroit, and atomizing areas were exposed to toxic concentrations of beryllium dust. Medical evaluation resulted in the identification of 1 case of beryllium dermatitis, one case of beryllium pneumonitis and 9 workers with chronic beryllium pulmonary disease. Excessive noise levels that could result in noise induced hearing loss were recorded in the Detroit room. Recommendations are made for control of environmental exposure of employees and for medical surveillance of exposed employees.

31944 (PB–89-161277/XAB) **Health-hazard evaluation determination report No. 76-33-431, 76-34-431, Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia.** Chrostek, W.J.; Straub, W.; Powell, K. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Sep 1977. 20p. (HHE–76-033-431). Available from NTIS, PC A03/MF A01.

See also PB–82-150210.

A health-hazard evaluation investigation was conducted by NIOSH on July 27-29, 1977, at the Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia in the facility for the production of virgin aluminum metal by electrolytic reduction of alumina using prebaked carbon electrodes and cryolite flux. Environmental sampling revealed that the anode setters in the pot area may be exposed to excessive concentrations of aluminum oxide, while fluoride exposure was not excessive. In the casting area exposure to carbon monoxide, sulfur dioxide and ammonia was minimal. According to available medical data, the findings related to determining whether a high rate of coronary disease existed were inconclusive. Recommendations are made for environmental control and medical surveillance of employees.

31945 (PB–89-161483/XAB) **Prevention reference manual; chemical specific. Volume 13. Control of accidental releases of methyl isocyanate. Final report, June 1987-September 1988.** Davis, D.S.; DeWolf, G.B.; Nash, R.A.; Stelling, J.S. Radian Corp., Austin, TX (USA). Feb 1989. 75p. (DCN–87-203-068-05-05). Available from NTIS, PC A04/MF A01.

See also PB–88-103734.

This report is one of a series of manuals addressing accidental releases of toxic chemicals. Methyl isocyanate (MIC) has an Immediately Dangerous to Life and Health (IDLH) concentration of 20 ppm, making it a substantially acute toxic hazard. Reducing the risk associated with an accidental release of MIC involves identifying some of the potential causes of accidental releases that apply to processes that use MIC. The manual identifies examples of potential causes and measures that may be taken to reduce the accidental-release risk. Such measures include recommendations on plant design practices, prevention, protection, and mitigation technologies, and operation and maintenance practices. Conceptual cost estimates of possible prevention, protection, and mitigation measures are provided.

31946 (PB–89-161657/XAB) **Health-hazard evaluation determination report No. 75-121-281, Penn Central Transportation Company, Philadelphia, Pennsylvania.** Straub, W.E. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Apr 1976. 8p. (HHE–75-121-281). Available from NTIS, PC A02/MF A01.

Portions of this document are not fully legible.

A health-hazard evaluation investigation was conducted by NIOSH at the computer center of the Penn Central Transportation Company, located in the Food Fair building in Philadelphia, Pennsylvania. Environmental air sampling, medical evaluation and a review of the pertinent literature disclosed that exposure of clerks to asbestos and fibrous glass was not toxic at the concentrations measured during the survey. No judgment was made as to the cause of dermatitis reported by some of the workers; however, the condition does not appear to be related to asbestos or fibrous-glass exposure.

31947 (PB–89-161673/XAB) **Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana.** Price, J.H. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Oct 1977. 26p. (HHE–77-031-432). Available from NTIS, PC A03/MF A01.

See also PB–88-221270.

A health-hazard evaluation investigation was conducted by NIOSH on January 17-20 and May 25-26, 1977, in the Pickling and Chipping Dock of the Inland Steel Corporation, East Chicago, Indiana, a facility involved in removal of defects from steel billets and blooms before being processed in a rolling mill. The survey regarded exposures to crystalline silica, lead, sulfuric acid and contaminants released from abrasive grinding operations. Environmental sampling revealed excessive lead exposure when lead-containing steel was cut with an oxyacetylene torch. The airborne concentrations of all other contaminants were not potentially toxic. Review of medical questionnaires revealed previous symptomatic conditions (respiratory irritation, eye irritation, dermatitis and dental anomalies) compatible with exposure to sulfuric acid. Recommendations are made for maintaining a safe and healthful work environment.

31948 (PB–89-161723/XAB) **Health-hazard evaluation determination report No. 77-44-435, Keller Columbus, Inc., Columbus, Ohio.** Belanger, P.L. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Oct 1977. 24p. (HHE–77-044-435). Available from NTIS, PC A03/MF A01.

A health-hazard evaluation investigation was conducted by NIOSH at Keller Columbus Incorporated, Columbus, Ohio, a facility engaged in the production of gas, electric, and double-oven stoves. The survey regarded workers alleged exposure to toxic dusts, exhaust fumes, and toxic vapors, as well as employees not using the correct respirators. Environmental sampling indicated that the levels of nuisance dust and airborne solvents in air did not exceed the current standards; the same was valid for the airborne concentrations of fibrous glass. Carbon monoxide gas levels generated by the fork-lift trucks exceeded the NIOSH recommended standard. Recommendations are made for maintaining and improving working conditions.

31949 (PB–89-161863/XAB) **Evaluation of HCl continuous-emission monitors. Final report, May 1986-May 1987.** Shanklin, S.A.; Jernigan, J.R.; Steinsberger, S.C. Entropy Environmentalists, Inc., Research Triangle Park, NC (USA). Mar 1989. 113p. Available from NTIS, PC A06/MF A01.

This report presents the findings obtained from the field evaluation of commercially available HCl monitoring equipment at a municipal waste-fired boiler which was not equipped with HCl emission-control equipment. The analyzers were operated continuously during a two-month test period. The measurement techniques employed by the HCl monitors evaluated were IR gas-filter correlation, specific-ion electrode, wet-chemical colorimetric, dry-reaction colorimetric, and gas membrane galvanic-cell. Except for the gas membrane galvanic-cell monitor, the HCl monitoring equipment produced effluent measurements that were in good agreement with concurrent reference measurements. The results comparing the continuous emission monitor data to the reference wet-chemistry measurement

data do not indicate biases for any of the monitor measurement techniques because of analytical interferences present in the effluent of this municipal refuse-fired boiler. Also, both in-stack dilution systems and the nondilution, heat-traced sampling system were found to reliably provide representative effluent samples to the analyzers.

31950 (PB–89-161954/XAB) **Quality-assurance audits of the EPA (Environmental Protection Agency) state-operated precipitation-collection network: 1987.** Eaton, W.C.; Moore, C.E.; Murdoch, R.W.; Ward, D.A. Research Triangle Inst., Research Triangle Park, NC (USA). Mar 1989. 66p. Available from NTIS, PC A04/MF A01.

See also PB–87-208740.

The collection of precipitation and the measurement of its constituents are important steps in attaining a better understanding of the distribution and effects of acid rain in the United States. The document is a report of the findings from quality-assurance and technical-assistance visits made in 1987 to the 29 sites that comprise the State Operated Precipitation Network. The network is staffed mainly by personnel from state environmental agencies and foresty commissions. It is under the overall sponsorship of regional and national offices of the Environmental Protection Agency. Procedures followed in conducting the site visits are described. Results of systems and performance audits are discussed for siting, collection equipment, and field laboratories.

31951 (PB–89-161962/XAB) **Development and validation of a test method for acrylonitrile emissions.** Fulcher, J.N.; Howe, G.B.; Jayanty, R.K.M.; Peterson, M.R. Research Triangle Inst., Research Triangle Park, NC (USA). Mar 1989. 51p. Available from NTIS, PC A04/MF A01.

Acrylonitrile (AN) has been identified as a suspected carcinogen and may be regulated in the future as a hazardous air pollutant under Section 112 of the Clean Air Act. A method was validated that utilizes a midget impinger containing methanol for trapping AN vapors followed by a charcoal tube for detecting any AN lost from the impinger. The analysis was performed by capillary gas chromatography with a nitrogen selective detector. The accuracy of the method was determined to be 100 + or - 4.6% from 11 tests performed in the laboratory covering the range of 10.6 to 1038 ppm AN and 0 to 40% moisture. The overall precision was 3.3%. Field testing of the method was conducted at two different sites.

31952 (PB–89-164677/XAB) **Industrial-hygiene survey, Bachmeier and Company, Kearny, New Jersey, November 4-8, 1985.** Hills, B.; Bloom, T.F. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 27 Dec 1988. 40p. (IWS–093.27). Available from NTIS, PC A03/MF A01.

An industrial-hygiene survey was conducted at Bachmeier and Company, Incorporated, Kearny, New Jersey. This was a dye-distribution facility which blended and repackaged imported and domestic dyes for resale. Possible worker exposure to benzidine congener dyes was the purpose of the visit. Exposure to o-dianisidine-based dye, an o-tolidine based dye and a benzidine based dye were evaluated. Air samples and surface wipe samples were taken along with employee urine specimens. During the survey a blending operator poured a liquid o-dianisidine based dye for 10 minutes during which time the sampling equipment indicated no detectable exposure to the worker. During a blending of a dry benzidine based dye operation the blending operator had the highest exposure of 1.18 mg/m^3. The forklift operator registered an exposure of 0.008 mg/m^3 and the shipping employee had an exposure of 0.005 mg/m^3. No detectable levels of free benzidine or benzidine congener metabolites were found in the urine of blending and forklift operators. Two urine samples from a shipping employee revealed 3.4 and 3.8 micrograms/liter of free benzidine in the urine. No free o-dianisidine or o-tolidine metabolites were detected in any urine samples. Recommendations were made to reduce dye exposures at the work site through the implementation of engineering controls and employee training.

31953 (PB–89-164685/XAB) **Industrial-hygiene survey report, Cain Chemical, Inc., Bayport Plant, Pasadena, Texas, June 1-2, 1988.** Piacitelli, G.; Votaw, D.; Krishnan, R. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 11 Jan 1989. 27p. (IWS–134.20.11). Available from NTIS, PC A03/MF A01.

A walk-through survey was conducted at the Cain Chemical Company, Petrochemical Division, Pasadena, Texas for the purpose of evaluating worker exposure to four ethylene glycol ethers: 2-methoxyethanol (2-ME), 2-methyoxyethanol-acetate (2-MEA), 2-ethoxyethanol (2-EE), and 2-ethyocyethanol-acetate (2-EEA). The potential for inhalation and dermal exposures to the ethers existed at this site where the following activities were being conducted: loading of trucks or rail cars, decontamination of process equipment, and collection of quality control samples. Full-shift exposures to 2-ME and 2-EE were very low. Measurable short-term inhalation exposures during the collection of quality-control samples ranged up to 1.22 parts per million (ppm) for 2-EEA and 2.45 ppm for 2-ME. Near pumping equipment the airborne emissions reached 0.05 ppm for 2-EEA and 0.44 ppm for 2-ME. The authors recommend the installation of local exhaust ventilation at the quality control sampling location to reduce exposure levels. Also recommended is that impermeable coveralls be provided to workers involved in handling glycol ether liquids and that improved emission controls be instituted in the pumping equipment, specifically multiple seals.

31954 (PB–89-164693/XAB) **Industrial-hygiene survey report, P. D. George Company, St. Louis, Missouri, February 22-25, 1988.** Boeniger, M.F. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Nov 1988. 16p. (IWS–143.22). Available from NTIS, PC A03/MF A01.

In an attempt to gather information related to employee exposure to 4,4'-methylenedianiline (MDA) in a batch type mixing operation, a visit was made to the P. D. George Company, St. Louis, Missouri. At this site, imide ester resin was manufactured for wire coating. The process was performed as a batch operation in which large amounts of pure MDA were used. The study indicated that airborne dust was generated during the dumping of MDA into the reactor's loading chute, but personal protection eliminated much of the respiratory hazard. Contamination of the workplace and poor work practices both probably resulted in dermal exposure, but this was not confirmed by actual measurement. Urine samples were all negative for MDA at the detection limits of 1.0 parts per billion, suggesting that exposures were not sufficient to be detected by this method. The authors recommend that decontamination procedures be implemented and performed after MDA is used. Dry cleanup should be performed with a vacuum installed with a HEPA filter and final decontamination should be performed with a methanolic solution of p-dimethylaminobenzaldehyde. Workers must wear full personal protective equipment while handling MDA. These garments must not be reworn or stored with street clothes. Workers should wash and shower after handling MDA.

31955 (PB–89-164701/XAB) **Industrial-hygiene survey report, Wabash Magnetic Company, Huntington, Indiana, May 24-26, 1988.** Boeniger, M.F. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jan 1989. 19p. (IWS–143.23). Available from NTIS, PC A03/MF A01.

A walk-through survey was made at Wabash Magnetic Company, located in Huntington, Indiana for the purpose of determining the extent of worker exposure to 4,4'-methylenedianiline (MDA) in a batch type mixing operation and user of B-stage resins. At this site the chemical was used as a hardening agent to produce the resins used to make transfer-molded parts. Air, wipe, bulk, and urine samples were taken to determine exposure levels. In both the formulating and molding departments, evidence was found for the possible inhalation of and dermal contact with MDA. Air concentrations were detectable, but were below the permissible exposure level of 10 parts per billion (ppb) proposed by OSHA. Of seven workers monitored by urinalysis, two were excreting detectable amounts of MDA with the higher concentration being 16 ppb. The author recommends a combination of modified work practices and alternative personal protection to reduce exposures. A vacuum installed with a HEPA filter should be used in the dry cleanup processes in the mixing and formulating departments and workers should wear a glove more resistant to permeation than the cotton ones now in use at the site. Gloves made of polyvinylchloride or natural latex are suggested.

31956 (PB–89-164719/XAB) **Walk-through survey report, Central Brass Manufacturing Company, Cleveland, Ohio, March 20, 1987.** Zaebst, D.D.; Seligman, P.J.; Bloom, T.F. National Inst.

for Occupational Safety and Health, Cincinnati, OH (USA). Nov 1988. 26p. (IWS–158.12). Available from NTIS, PC A03/MF A01.

In order to evaluate controls used to reduce or eliminate worker exposures to lead, a survey was undertaken at the nonferrous foundry, Central Brass Manufacturing Company, Cleveland, Ohio. After a review of the exposure and blood lead monitoring data, along with interviews with management and union officials and a tour of the facility, the investigators conclude that there is evidence to support excessive exposures to work-place lead at the time of compensation claims made early in 1985. Since that time the company has taken steps to reduce these exposures. Some engineering controls had been installed in October of 1984, including portable flexible-duct local exhaust hoods, side draft local exhaust systems and traveling hoods. Improvements or replacements were also made to existing equipment including doubling the ventilation capacity of the exhaust system on polishing equipment and replacing local exhaust hoods on all grinding machines. All new employees receive a complete physical examination including audiometry, pulmonary function test, and blood-lead screening. The frequency of subsequent blood lead monitoring was based on the previous blood-levels. The respiratory protection program seemed generally adequate. With the improvements made, a correlation between the decline in ambient lead and blood-lead levels was noted.

31957 (PB–89-164727/XAB) **Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio.** Crandall, M.S.; Boiano, J.M.; Fidler, A.T.; Cantor, F. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Oct 1988. 34p. (HETA–86-053-1933). Available from NTIS, PC A03/MF A01.

The Gray Printing Company, located in Fostoria, Ohio was studied for potential employee exposures to solvents used in the offset-printing process at that site. The company produced 30 monthly magazines plus various commercial catalogs and brochures. The employment at the site was 185 persons. Equipment used in the production of printed material included photographic-typesetting and sheet-fed and roll fed offset lithographic printing processes. Over two workdays the sheet fed press operator's isopropanol exposures ranged from 247 to 501 mg/m^3 with personal breathing zone naphtha concentrations of 0.03 to 8.9 mg/m^3. The web press operator's naphtha exposures ranged from 0.03 to 7.7 mg/m^3. These workers were also exposed to low concentrations of isopropanol. The highest short term isopropanol exposure was 726 mg/m^3. Short term exposures to blanket and roller cleaning solvent were low, less than 10 mg/m^3. A higher than expected reporting of symptoms related to central nervous system depression, difficulty in concentrating, dizziness, cough, chest pain, and dry skin were noted among workers. The authors conclude that there was an increased prevalence of neurotoxic, respiratory, and skin problems among workers using organic solvents. Due to the prevalence of these symptoms, the authors recommend measures for reducing employee exposure to solvents.

31958 (PB–89-165948/XAB) **Annual report on establishment and operation of the eastern fine-particle and visibility network.** Hendler, A.; Collins, L.; Howes, J. C-E Environmental, Inc., Chapel Hill, NC (USA). Mar 1989. 67p. Available from NTIS, PC A04/MF A01.

See also PB–87-180055.

The Eastern Fine Particle and Visibility Monitoring Network (EFPVN) was established to obtain long-term, regionally-scaled measurements of visibility and related fine-particle characteristics throughout the eastern U.S. The overall goal of the EFPVN is to provide data through which a quantitative assessment can be made regarding trends and causes of visibility impairment in the East. This goal will be achieved through continuous monitoring of atmospheric light-scattering coefficients, 24-hour integrated measurements of fine-particle mass, elemental composition and optical absorption coefficient, and photographic measurements of visual range taken three times each day. The program is expected to run for five years. During the first year of the EFPVN, five monitoring stations were established. Three of the stations are located in the southeastern U.S., where airport observations indicate as much as 60% reduction in visual range during the past forty years. The remaining stations are located in the Northeast, where long-term trends are less evident. Data collected and processed through July 1988 are summarized.

31959 (PB–89-165955/XAB) **Health-hazard evaluation determination report No. 75-19-276, Masonite Corporation, Evendale, Ohio.** Kominsky, J.R.; Anstadt, G.P. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Apr 1976. 29p. (HHE–75-019-276). Available from NTIS, PC A03/MF A01.

A health-hazard evaluation investigation was conducted by NIOSH on April 8-10 and August 19-20, 1975 at the Masonite Corporation, Evendale, Ohio, a facility engaged in the fabrication of wood parts for various commercial products, using primarily Masonite hardboard. The survey regarded worker exposure to wood dust in the saw-sanding department. Airborne concentrations of wood dusts were toxic to helpers at the multi-blade rip and 1-man cutoff saws and router operator. Medical examination revealed evidence of dust induced irritation of the conjunctiva and upper respiratory tract. It was determined that the diehl rip saw helper had allergic contact dermatitis secondary to wood dust exposure. Available evidence suggested that formaldehyde and phenol were not toxic in the concentrations found. Recommendations are made for environmental control and use of personal protective equipment.

31960 (PB–89-165963/XAB) **Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri.** Hervin, R.L.; Emmett, E.A. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jun 1976. 36p. (HHE–75-102-304). Available from NTIS, PC A03/MF A01.

Exposures to toxic chemicals were investigated for the Sellers and Marquis, A. J. Shirk, Western, and Quality Roofing Companies, Kansas City, MO, during joint installation of roofing for a 46-acre warehouse in Lenexa, KS. The medical and environmental survey was conducted on September 4 and 18, 1975. Asphalt and coal tar pitch were suspected causes of worker reports of skin and eye irritations. Personal and area air samples and total particulates samples were collected and analyzed for particulate polycyclic organic matter (PPOM), coal tar pitch volatiles (CTPV), polycyclic aromatic hydrocarbons (PAH), benzo(a)pyrene (BaP), and benzo(e)pyrene (BeP). All asphalt and duct samples were below 2 milligrams per cubic meter (mg/CuM) and under the ACGTH recommended threshold limit value (TLV) of 5 mg/CuM for asphalt fumes and 10 mg/CuM for fibrous glass dust. Six workers out of 26 were exposed to potentially toxic concentrations of PPOM which exceeded the TLV of 0.20 mg/CuM. Exposure concentrations for 3 of 7 workers exceeded the standard. BaP and BeP were not detected. A total of 69 and 50% of the examined roofers reported skin photosensitivity and conjunctival symptoms. Examinations verified moderate or mild conjunctivitis, photosensitization, and generalized erythema among the workers.

31961 (PB–89-166003/XAB) **Health-hazard evaluation determination report No. 74-9-174 Wheeling Steel Corporation, Steubenville, Ohio.** Rosensteel, R.E. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Feb 1975. 15p. (HHE–74-009-174). Available from NTIS, PC A03/MF A01.

Examination of the working conditions at a steel mill revealed that dust containing free silica is potentially toxic to blast furnace workers and to personnel working in the stockhouse area. This determination is based upon air concentration levels of total dust containing free silica up to four times the Federal Standard for blast furnace workers and up to twenty-eight times the Federal Standard for larry car operators in the stockhouse as well as criteria concerning the toxic effects of free silica. It has also been determined that potentially toxic exposures did not exist on the day of evaluation to the crane operator in the stripper building from exposure to iron oxide fume, carbon monoxide, and free silica or to maintenance workers in the 44 inch soaking pit area from exposure to sulfur dioxide and carbon monoxide. Detectable levels of carbon monoxide, sulfur dioxide, and iron oxide fumes were not measured while the free silica level was less than 0.4 of the Federal Standard.

31962 (PB–89-166052/XAB) **Health-hazard evaluation determination report No. 73-123-298, Campbell Plastics, Inc., Schenectady, New York.** Burton, D.J. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jun 1976. 19p. (HHE–73-123-298). Available from NTIS, PC A03/MF A01.

A health-hazard evaluation investigation was conducted by NIOSH on February 5-6, April 2-3 and December 4, 1974, and on

May 9, 1975, at Campbell Plastics, Inc., Schenectady, New York, a manufacturer of polyvinyl chloride trim for automobiles. The survey regarded exposure by inhalation of smoke, fumes and vapor from work with polyvinyl chloride, toluene, and methyl ethyl ketone, and also skin contact with the same agents. Environmental sampling failed to establish toxic levels of vinyl chloride monomer in the air. Polyvinyl chloride smoke and fumes caused minor eye and respiratory irritation in about 40% of the workers; in one case a chronic respiratory condition was exacerbated by exposure to the plastic. Two workers presented hypersensitivity to the hot plastic products. Past toxic exposure to solvents has been corrected by covering the solvent baths. Recommendations are made for improved ventilation and solvent-handling methods.

31963 (PB–89-166300/XAB) **Health-hazard evaluation determination report No. 76-6-294, J. A. Devine, D.D.S., Cheyenne, Wyoming.** Gunter, B.J. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). May 1976. 7p. (HHE–76-006-294). Available from NTIS, PC A02/MF A01.

A health-hazard evaluation conducted at the J. A. Devine Dental Clinic in Cheyenne, Wyoming, indicates that concentrations of mercury during the evaluation range from less than 0.01 microgram to 0.18 milligram per cubic meter, which is in excess of the NIOSH standard of 0.05 milligram per cubic meter and hence a potential health hazard to the employees. Recommendations include tightly closed capsules during amalgamation, removal of carpeting from dental operatories, salvaging all amalgam scraps and storing in a closed container with a layer of water over the amalgam, immediate vacuuming of spilled mercury using special vacuum cleaners fitted with charcoal filters, elimination of the hand squeezing of amalgam, and comprehensive medical examination of all employees including analysis of urine, and looking for specific symptoms of mercury absorption such as weight loss, sleeplessness, tremors, and personality change.

31964 (PB–89-166573/XAB) **Health-hazard evaluation determination report No. 75-146-254, Custom Furniture and Cabinets, Inc., Post Falls, Idaho.** Apol, A.G. National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Jan 1976. 13p. (HHE–75-146-254). Available from NTIS, PC A03/MF A01.

A health-hazard evaluation investigation was conducted by NIOSH on August 19-20, 1975, at the Custom Furniture and Cabinets, Inc., a facility engaged in the manufacturing of custom-built kitchen cabinets. The survey regarded exposure to solvent vapors present in the paint room. It was determined that the air concentration of acetone, aliphatic naphtha, ethylene glycol monoethyl ether acetate, isopropyl alcohol, and toluene were toxic. This determination was based on air concentrations that ranged from 0.32 to 2.18 times the current accepted exposure limits, and on questionnaire information obtained from exposed employees which revealed the presence of eye irritation, dizziness, light-headedness, headaches and dry hands. Recommendations are made for improving work practices and exhaust ventilation, as well as for the establishment of a respirator program.

31965 (PB–89-859862/XAB) **National Acid Precipitation Assessment Program (NAPAP): pollutant emission inventories available on tape inventories. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 57p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning electricity utility pollutant emission inventories related to the acid-deposition phenomenon developed within the National Acid Precipitation Program (NAPAP). The inventory spans the 48 contiguous United States and 10 Canadian provinces providing detailed point source data and area source information. Special emphasis is placed on meeting data needs of atmospheric modelers, emission forecasters, and policy analysts. Available from NTIS on magnetic tape, including tape documentations and reports. (Contains 69 citations fully indexed and including a title list.)

31966 (PNL–6815) **Well installation and ground-water sampling plan for 1100 Area environmental monitoring wells.** Bryce, R.W. Pacific Northwest Lab., Richland, WA (USA). May 1989. 185p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE89012220/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report outlines a plan for the installation and sampling of five wells between inactive waste sites in the 1100 Area of the Hanford Site and Richland City water supply wells. No contamination has been detected in water pumped from the water supply wells to date. The five wells are being installed to provide for early detection of contaminants and to provide data that may be used to make decisions concerning the management of the North Richland Well Field. This plan describes the existing waste disposal facilities and water supply wells, hydrogeology of the area, well completion specifics, and the data to be gathered from the five new wells. 26 refs., 8 figs., 4 tabs.

31967 (PNL–6824) **Borehole summary report for five ground-water monitoring wells constructed in the 1100 Area.** Bryce, R.W.; Goodwin, S.M. Pacific Northwest Lab., Richland, WA (USA). May 1989. 231p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE89012219/JAW. Available from NTIS, PC A11/MF A01 - OSTI.

This report contains the data collected during the installation and initial sampling of five ground-water monitoring wells between the 1100 Area and Richland City water supply wells. The five wells were installed to provide for early detection of contaminants and to provide data that may be used in making decisions on the management of the North Richland Well Field and recharge basins. 2 refs., 1 fig.

31968 (PNL–6885) **The MAP3S Precipitation Chemistry Network: Data and quality control summary for 1986 and 1987.** Dana, M.T.; Barchet, W.R. Pacific Northwest Lab., Richland, WA (USA). May 1989. 115p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. Order Number DE89013341/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report, the tenth in a series documenting results from the MAP3S Precipitation Chemistry Network, contains a statistical summary of daily precipitation chemistry data from the nine-site network in the eastern United States, both for the years 1986 and 1987 individually and for the period 1977 through 1987. In addition, external quality assurance results for 1986 and 1987 are summarized. 17 refs., 21 figs., 20 tabs.

31969 (RIVM–00-06) **Dutch priority programme on acidification: Summary report, Acidification research, 1984–1988.** Bresser, T. (ed.). Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands). 18 Nov 1988. 186p. Order Number DE89013199/JAW. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI.

The present final report has been drawn up by the project group. The project group has reached several conclusions. The current deposition level averages 5300 equivalents of potentially acidifying substances per hectare per year for the entire Netherlands, variations for different regions ranging from 4200 to 6400 equivalents. The inaccuracy of these figures is 25 to 30%. Deposition may reach higher values (up to over 10,000 equivalents) locally, especially in forest edges. About 2200 out of the 5300 equivalents of potentially acidifying substances for the entire Netherlands originate from Dutch sources and 3100 from sources abroad. Areas with a relatively high deposition are found especially in the east of Brabant and the north of Limburg (the surroundings of the Peel) and the Achterhoek. The current effects of acidification in the Netherlands are serious. Over half of the Dutch forest is no longer vital, a considerable share of the heathlands has been overgrown by grass, the majority of the fens has acidified, and in several places the nitrate concentration of the ground water under nature reserves has increased considerably and is still increasing. 100 refs.

31970 (SSC/TLB–1988) **Vocabulary of acid precipitation and air pollution. Terminology bulletin 175.** Rivard, D. Department of the Secretary of State of Canada, Montreal, PQ (Canada). Terminology and Linguistic Services Branch. 1988. 263p. (In English and French). (MICROLOG–89-00242). Available from Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, Canada K1A 0S9; $9.95 IN OTHER COUNTRIES $11.95 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This English-French vocabulary includes about 600 concepts on acid rain as well as general air pollution terminology. A large number of official names and their abbreviations have also been incorporated into the dictionary. The vocabulary is arranged alphabeticaly into a series of terminology files, each of which begins with a main entry in English and French. The main entry represents those terms selected as being of superior terminological quality. The main entry may be followed by sub-entries, which are synonyms, and may also be followed by a definition, an example of usage, a defining context, or a terminological observation. Sub-entries are in the same alphabetical sequence as the main entries, and refer the reader to the main entry. An index of French terms is also included. 243 refs.

31971 (UCID–21631) **Introduction to background materials for Workshop No. 1: Global climate change and its effects on California.** Knox, J.B. Lawrence Livermore National Lab., CA (USA). Mar 1989. 11p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE89013381/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the fall of 1988, the University of California organized a new public service initiative on global climate change in response to inquiries and requests from members of Congress and the Department of Energy. This new system-wide initiative involves all of the University of California campuses and the University's three national laboratories at Berkeley, Los Alamos, and Livermore. Our goal in organizing this new Greenhouse Initiative is to focus the multidisciplinary resources of the UC campuses and the team-oriented research capabilities of the laboratories on the prospect of global warming and its plausible associated effects on the planet and its nations, on what may be the most challenging global environmental issue facing the world in the 1990's and beyond. With the consultation of many people, we have organized a series of three workshops all scheduled to occur by November 1989, to assure that our findings will be available in a timely fashion to the national dialogue on global warming and the national studies in progress. We briefly summarize the scope of these three workshops. 1 tab.

31972 (UCRL–99883) **Beyond CO_2: The other greenhouse gases.** Wuebbles, D.J. Lawrence Livermore National Lab., CA (USA). May 1989. 15p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-890692–8: 82. Air and Waste Management Association annual meeting and exhibition, Anaheim, California, USA, 25-30 Jun 1989). Order Number DE89011893/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Most of the concern about potential effects of greenhouse gases on the future state of climate has been related to the growing atmospheric concentrations of carbon dioxide. Concentrations of a number of other radiatively important atmospheric trace constituents are also changing, many at rates much larger than the current rate of change in CO_2 concentrations. For example, the methane concentration is increasing one percent per year, while the concentrations of several chlorofluorocarbons are increasing by 4–5 percent per year. In each case, the increasing concentrations of these gases, which are emitted at the earth's surface, is thought to be related primarily to human activities. The combined effects of these other greenhouse gases on climate could be cumulatively as large as those estimated for CO_2. Besides the direct radiative effects that these gases can have on climate, there are also potential indirect effects on climate through their chemical interactions with other greenhouse gases, such as ozone and water vapor. Evidence is mounting that such indirect effects are occurring. This paper describes what is known regarding these changing greenhouse gas concentrations and their budgets, and examines the uncertainties affecting their influence on climate. It also attempts to establish criteria for determining their potential effects on climate in relation to CO_2. 13 refs., 5 figs., 3 tabs.

31973 (UCRL–99926) **Preventing depletion of stratospheric ozone: Implications on future aircraft emissions.** Kinnison, D.E.; Wuebbles, D.J. Lawrence Livermore National Lab., CA (USA). Apr 1989. 17p. Sponsored by DOE Environment Health & Safety. DOE Contract W-7405-ENG-48. (CONF-890692–4: 82. Air and Waste Management Association annual meeting and exhibition, Anaheim, California, USA, 25-30 Jun 1989). Order Number DE89009964/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There is much renewed interest in the development of faster aircraft for intercontinental passenger flights. Such aircraft would likely spend a large fraction of their flight time in the stratosphere, at altitudes as high as 35 km. It is important, in order to present the problems with the proposed supersonic-transport that occurred in the early 1970's, that the aircraft industry work together with the atmospheric science community to insure that future aircraft emissions will not deplete stratospheric ozone. In this study, we have used our two-dimensional model of the troposphere and stratosphere to examine the sensitivity of stratospheric ozone to such emissions. Initial results indicate, for commercial fleets as large as proposed for the original SST and depending on the odd-nitrogen emissions per engine, that substantial decreases in stratospheric ozone could result. The decrease in ozone is sensitive to the altitude and latitude in the emissions. Effects on ozone, for the same emission rate, tend to be larger as altitude increases, until a maximum effect is reached near 30 km. 10 refs., 7 figs.

31974 (UCRL–99927) **Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint.** Connell, P.S.; Wuebbles, D.J. Lawrence Livermore National Lab., CA (USA). Apr 1989. 13p. Sponsored by NASA;OUS. DOE Contract W-7405-ENG-48. (CONF-890692–2: 82. Air and Waste Management Association annual meeting and exhibition, Anaheim, California, USA, 25-30 Jun 1989). Order Number DE89010238/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Current understanding of atmospheric processes in the troposphere and stratosphere, in particular, stratospheric ozone-controlling photochemistry, allows evaluation of the effects on the stratosphere of chlorine-containing compounds envisioned as CFC (chlorofluorocarbon) replacements prior to their production and release. We employ a two-dimensional (latitude and altitude) computational representation of the troposphere and stratosphere which incorporates physical processes, e.g., species transport and radiative transfer, and homogeneous photochemical processes. Laboratory measurements of OH and $O(^1D)$ reactivity and spectral parameters of the alternative HCFC (hydrochlorofluorocarbon) compounds were used as input. The model-derived ozone depletion potential (ODP) is a defined quantity relating the effect on ozone of emission of a species to the model-calculated effect of a standard compound, here CFC-11 ($CFCl_3$). Globally and annually averaged ozone depletion potentials vary from less than .02 to greater than 1.0 for various CFCs and HCFCs, primarily as a result of differences in calculated atmospheric lifetimes. Differences in stratospheric photochemistry among CFCs and HCFCs play a smaller but significant role. Zonally averaged ODPs for some compounds can range over a factor of three with latitude, however, as a result of differences in stratospheric lifetime and the altitude profile of Cl release in CFC or HCFC loss processes. 6 refs., 4 figs., 3 tabs.

31975 (UCRL–99928) **Cloud albedo, greenhouse effects, atmospheric chemistry, and climate change.** Penner, J.E. Lawrence Livermore National Lab., CA (USA). Mar 1989. 16p. Sponsored by DOE/DP;EPA. DOE Contract W-7405-ENG-48. (CONF-890692–3: 82. Air and Waste Management Association annual meeting and exhibition, Anaheim, California, USA, 25-30 Jun 1989). Order Number DE89010239/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Changes in global atmospheric chemistry and climate are taking place as a result of observed trends in long-lived species such as CO_2, CH_4, N_2O, and the CFC's. The continuation of these trends is expected to eventually lead to a major atmospheric warming which might profoundly affect the society we live in. Trends in shorter-lived species such as NO_x are also suspected. These trends are not as well established, because the shorter-lived species vary spatially and temporally. Trends in NO_x would be expected to lead to increases in tropospheric ozone which would add to the warming created by the other greenhouse gases. Trends in NO_x could also impact the concentration of OH, a scavenger for many other species. In addition to these changes increases in sulfur emissions may alter cloud optical properties. The changes in cloud optical properties could possibly offset the warming expected from increases in greenhouse gases, depending on the role of natural oceanic sulfur emissions of DMS. This paper summarizes recent research in these areas, and the interactions of climate and

atmospheric chemistry. It is argued that the development of three-dimensional models will be necessary for a quantitative evaluation of the effects of short-lived species on global climate. 39 refs., 1 fig., 3 tabs.

31976 (UCRL–100721-Rev.1) **Climate projections with regional resolution.** MacCracken, M.C. Lawrence Livermore National Lab., CA (USA). Mar 1989. 12p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-890695–1: 4. international conference of the Israel Society for Ecology and the Environmental Quality Sciences, Jerusalem, Israel, 4-8 Jun 1989). Order Number DE89009261/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The increasing atmospheric concentrations of carbon dioxide and other radiatively active gases will enhance the ability of the atmosphere to trap infrared radiation and thereby lead to warming of the climate. Numerical models suggest that the global average surface air temperature can be expected to increase a few degrees during the twenty-first century. This estimate is probably uncertain by a factor of at least two. The uncertainties in estimates of regional changes of temperature and precipitation are even greater. Despite these uncertainties, there is broad agreement that the persistence of such changes would be unprecedented in historical times. 30 refs.

31977 Chain build-up procedure in computing the structures of biologically active polypeptides and proteins. Pincus, M.R. (New York Univ. Medical Center, NY (USA)). pp. 12 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

The chain-buildup method is presented for sampling the low energy conformations of polypeptides and enzyme-substrate complexes. This method circumvents the multiple minimum problem. It is shown that the method can compute structures in agreement with experiment.

31978 Atmospheric chemistry of aldehydes: enhanced peroxyacetyl nitrate formation from ethanol-fueled vehicular emissions. Tanner, R.L. (Brookhaven National Lab., Upton, NY (USA)); Miguel, A.H.; de Andrade, J.B.; Gaffney, J.S.; Streit, G.E. *Environmental Science and Technology (USA),* 22(9): 1026-1034 (Sep 1988). DOE Contract AC02-76CH00016.

A preliminary study of the effects of enhanced acetaldehyde emissions from vehicles using ethanol and ethanol-containing fuel on peroxyacetyl nitrate (PAN) concentrations in urban air has been conducted in Rio de Janeiro. During this study, part of the second Rio de Janeiro Aerosol Characterization Study (RIO-JACS II), high concentrations of aldehydes (with low $HCHO/CH_3CHO$ ratios) were related to enhanced PAN formation rates, especially in the a.m. hours, leading to PAN concentrations as high as 5 ppbv even in the presence of high NO concentrations. Model simulations of smog photochemistry with high aldehyde emissions were in substantial agreement with observations, except nitric acid levels were higher than observed due in part to HNO_3 loss mechanisms not included in the model (e.g., uptake onto aerosol particles).

31979 Nitration of acephenanthrylene under simulated atmospheric conditions in solution and the presence of nitroacephenanthrylene(s) in ambient particles. Zielinska, B. (Univ. of California, Riverside (USA)); Arey, J.; Atkinson, R.; McElroy, P.A. *Environmental Science and Technology (USA),* 22(9): 1044-1048 (Sep 1988).

The nitration products resulting from the gas-phase reactions of acephenanthrylene with OH radicals in the presence of NO_x and with N_2O_5 were studied in an environmental chamber. The nitroacephenanthrylenes formed from the OH radical initiated reaction were compared with those produced from solution-phase nitrations of acephenanthrylene with N_2O_4, N_2O_5, and the nitronium ion and shown to be isomers other than those formed in these solution-phase reactions. The more abundant nitroacephenanthrylene formed in the OH radical initiated reaction was observed in an ambient particulate sample, suggesting that it was formed from this atmospheric reaction of gas-phase acephenanthrylene.

31980 Blue moons and large fires. Porch, W. M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)). *Applied Optics (USA),* 28(10): 1778-1784 (15 May 1989).

Theoretical analysis of simulations of optical effects from the 1950Canadian forest fires has revealed what conditions are necessary for large firesto cause blue moons and suns. This study shows how large fires can be used toimprove our understanding of long range pollution transport on a global scale aswell as the evolution of aerosol radiative effects so important to globalclimate studies. The most important aerosol characteristics are the initialsubmicron smoke particle concentration and areal extent of the fire and itseffect on fire plume dispersion. Capping clouds above the fire and nearsaturation humidity effects are simulated and found to help establish anomalousoptical effects. Data are included showing probable anomalous extinction eventsassociated with concentrated fire plumes.

5003 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 30621, 30624, 31062, 31064, 31916, 32009, 32010, 32050, 32953, 32957, 32958, 32959

31981 (CEA-DAS–560) **Overview of the assessment of the french in-field tritium experiment with computer codes.** Crabol, B.; Graziani, G.; Edlund, 0. CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete. Jan 1989. 5p. (CONF-880505–: 3. topical meeting on tritium technology in fission, fusion and isotopic applications, Toronto, Canada, 1-6 May 1988). Order Number DE89776468/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

In the framework of the international cooperation settled for the realization of the French tritium experiment, an expert group for the assessment of computer codes, including the Joint Research Center of Ispra (European Communities), Studsvik (Sweden) and the Atomic Energy Commission (France), has been organized. The aim of the group was as follows: - to help the design of the experiment by evaluating beforehand the consequences of the release, - to interpret the results of the experiment. This paper describes the last task and gives the main conclusions drawn from the work.

31982 (DOE/NV/10384–32) **Community Radiation Monitoring Program annual report, October 1, 1987–September 30, 1988.** Lucas, R.P. Jr.; Cooper, E.N. Nevada Univ., Las Vegas, NV (USA). Desert Research Inst. Mar 1989. 61p. Sponsored by DOE Defense Programs. DOE Contract AC08-85NV10384. Order Number DE89011839/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

In addition to enhancing and augmenting the collection of airborne radiation data from communities close-in to the test site, something that could easily be done with automated equipment, the Community Radiation Monitoring Program seeks to involve local residents of those areas. That is accomplished in two ways: hiring intelligent, well-respected members of the community as Station Managers and Alternates and providing them the training they need to respond to community concerns and questions; and then getting out to those and surrounding communities and holding meetings that serve not just as a forum for DOE and EPA spokesmen, but as a chance for concerned citizens to receive honest and credible answers to questions they might have. The Community Radiation Monitoring Program is, after more than seven years, sound and in focus. Continuous enhancements and "fine tuning" will serve to improve its ability to serve the people who live in communities surrounding the Nevada Test Site. 11 refs., 3 figs., 3 tabs.

31983 (EUR–11954) **Radiocesium in wheat of the Po plain.** Dominici, G.; Malvicini, A. Commission of the European Communities, Ispra (Italy). Joint Research Centre. 1988. 13p. (In Italian). Available from NTIS (US Sales Only), PC A03/MF A01.

The Cs-137 measurements of many wheat samples, which was cultivated in Po plain during 1986 and 1987, are reported. A relationship is also shown between the quantity of Cs-137, which is contained in total fall-out, and that in the wheat by direct deposition.

31984 (NVO–314) **A review of aerial radiological surveys of Nevada Test Site fallout fields 1951 through 1970.** EG and G Energy Measurements, Inc., Las Vegas, NV (USA). Dec 1987. 54p. Sponsored by DOE Defense Programs. DOE Contract AC08-83NV10282. Order Number DE89011289/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Aerial surveys of offsite fallout radiation fields from the Nevada Test Site began in the early 1950s and continued throughout the above-ground testing period. The results of the aerial surveys were used to support ground data in determining the extent of the fallout patterns. For the series of tests conducted in 1953 and 1955, the primary uncertainty of the results was knowing the location of the aircraft. Navigation was made from aeronautical charts of a scale 1:1,000,000, and errors in location of several miles were experienced. Another problem was that exposure rate readings made in the aircraft of 1 milliroentgen per hour or lower were not reliable. Exposure rate measurements above 1 milliroentgen per hour were more accurate, however, and are considered reliable to within a factor of two or three in predicting 3-foot exposure rate levels. For the 1957 series, the aircraft position data were quite accurate. Ground-level exposure rates predicted from aerial data obtained by the United States Geological Survey aircraft for the five-detector array were considered reliable to within ±40% or better for most of the surveys. When the single detector was used, the accuracy decreased to about a factor of two. Relative count rates obtained by the aircraft operated by the Atomic Energy Commission, Raw Materials Division, are probably valid, but quantitative determination of 3-foot exposure rates are not. The Aerial Radiological Monitoring System performed all the aerial surveys in the 1960s. However, the air-to-ground conversion factors used were too low. Using a corrected conversion factor, the predicted 3-foot exposure rates should be valid to ±40% in most fallout fields if all other parameters are considered. 40 refs., 30 figs., 6 tabs.

31985 (OEVS-Mitteilung–1988, pp. 193-198) **Investigations on natural radiation burden in Austria.** Tschirf, E. (Atominstitut der Oesterreichischen Universitaeten, Vienna (Austria)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The results of the investigations are shown in the geographical distribution of doses due to: cosmic radiation; overall outdoor doses; doses in buildings (indoor); the dependence of indoor doses on the construction material and age and radon decay product concentrations in dwellings. The mean overall dose in Austria is about 2,1 mSv/a. 7 refs., 6 figs. (qui).

31986 (PNL–6800-Pt.3) **Pacific Northwest Laboratory annual report for 1988 to the DOE Office of Energy Research: Part 3, Atmospheric sciences.** Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 65p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. Order Number DE89013340/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Disposal of spent fuel or high level nuclear waste into marine sediments would create high temperature-high gamma radiation environments adjacent to waste canisters. Under these conditions sediments will react producing pore waters that differ significantly from those occurring naturally. These changes may enhance canister corrosion or facilitate transport of radionuclides through unreacted sediments beyond the heated zone. In addition, the term "near field" needs clarification, as it is used widely without having a precise meaning. Research in three areas was undertaken to improve our understanding of near field chemical processes. Initially, isothermal experiments were carried out in "Dickson" hydrothermal systems. These were followed by an experimental program directed at understanding the chemical effects of temperature-gradient induced transport. Finally, additional experimentation was done to study the combined effects of hydrothermal conditions and intense gamma radiation. Having completed this body of experimental work, it was concluded that near field conditions are not an obstacle to the safe use of abyssal marine sediments for the disposal of spent fuel or high level nuclear wastes. 41 refs., 6 figs., 17 tabs.

31987 (SKI–87101) **Determination of radioactive emission origins based on analyses of isotopic composition.** Devell, L. Swedish Nuclear Power Inspectorate, Stockholm (Sweden); Studsvik Nuclear, Nykoeping (Sweden). 6 Nov 1987. 32p. (In Swedish). (STUDSVIK-NP–87-110). Order Number DE89613557/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The nature of radioactivity emissions can be determined through gamma spectroscopy of air samples with good precision, which means that the type of source of the emission may be found, e.g. nuclear weapons test, of nuclear power plant accident. Combined with information on wind trajectories it is normally possible to recognize time and area for the emission. In this preliminary study, the knowledge of and preparedness for such measurements are described. (L.E.).

5006 Regulations

Refer also to citation(s) 31928

31988 (AD-A–204505/2/XAB) **Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988.** Garrison, J.A. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). Dec 1988. 114p. (USAFOEHL–88-149EQ0686MEF). Available from NTIS, PC A06/MF A01.

Compliance testing for particulate and visible emissions was conducted on coal-fired boiler No. 3 in the Eielson AFB Central Heat and Power Plant on 12-22 July 88. The survey was conducted as a requirement for renewal of Alaska Department of Environmental Conservation Air Quality Control permit to operate 8331-AA001. Boiler No. 3 was tested at capacities of 100,000 lbs steam/hr and 90,000 lbs steam/hr. Results indicate that boiler No. 3 passed the visible emissions standard, but failed the particulate emission standard.

31989 (PB–89-161970/XAB) **Annual report on performance-audit results for POHC (Principal Organic Hazardous Constituents) testing during RCRA trial burns.** Jayanty, R.K.M.; Tompkins, S.B.; Howe, G.B. Research Triangle Inst., Research Triangle Park, NC (USA). Mar 1989. 56p. Available from NTIS, PC A04/MF A01.

See also PB–84-187889.

Audit materials containing Principal Organic Hazardous Constituents (POHCs) have been developed by AREAL for use by federal, state, and local agencies or their contractors to assess the accuracy of measurement methods during RCRA trial burn tests. Audit materials are currently available for 27 gaseous organics in 5, 6, 7, and 9 component mixtures at parts-per-billion levels (7 to 10,000 ppb) in compressed gas cylinders in a balance gas of nitrogen. The criteria used for the selection of the gaseous organic compounds is described. Stability studies indicate that all of the organics tested (with the exception of ethylene oxide and propylene oxide below 10 ppb levels) are stable enough to be used as reliable audit materials. Subsequent to completion of the stability studies, 129 performance audits have been initiated with the audit materials to assess the accuracy of the Volatile Organic Sampling Train (VOST) and bag measurement methods during or prior to RCRA trial burn tests.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

Refer also to citation(s) 30647, 31391, 31814

31990 (ANSTO/E–674) **Correcting the error in neutron moisture probe measurements caused by a water density gradient.** Wilson, D.J. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). 1988. 28p. Order Number

DE89616231/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

If a neutron probe lies in or near a water density gradient, the probe may register a water density different to that at the measuring point. The effect of a thin stratum of soil containing an excess or depletion of water at various distances from a probe in an otherwise homogeneous system has been calculated, producing an 'importance' curve. The effect of these strata can be integrated over the soil region in close proximity to the probe resulting in the net effect of the presence of a water density gradient. In practice, the probe is scanned through the point of interest and the count rate at that point is corrected for the influence of the water density on each side of it. An example shows that the technique can reduce an error of 10 per cent to about 2 per cent.

31991 (INIS-BR–1504) **Radiogeologic reconnaissance in Perus region, Sao Paulo, Brazil.** Coelho, P.E.F.P. Sao Paulo Univ., SP (Brazil). Inst. de Geociencias. 1980. 220p. (In Portuguese). Order Number DE89613483/JAW. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The determination of the means and the identification of the radiometric anomalies, and the classification of this anomalies orgin, and it probable correlation with uraniferous secundary minerals from Perus and Taipas were studied. Petrological, stratigraphic, tectonic and geochronological studies in this region were done. The radiometric anomalies was observed in granitic-pegmatic massifs, later Sao Roque group. The radiocitivity of this area was affected by lithology, being the pegmatite more radiogenic than granite. The topography is also a influent factor to detected radioactivity. The cinthylometry was efficient to U an Th anomalies detection. Three kinds of radioctive focus were detected by microautoradiography method.

31992 (INIS-mf–11357, pp. 255-264) **Investigation of seepage under the Wenxiakou dam using radiotracer.** Li Zhangsu (Nanjing Hydraulic Research Inst., Nanjing (China)). International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

This paper describes the result of seepage observation on the dam foundation of Wenxiakou Reservoir using radioactive NaI (I-131) as a tracer. The main feature of the observing technique is to ascertain the seepages between the dam foundation and the clay core wall and around the abutment by measuring vertical flow. The results obtained from the observation have provided some important information for planning the engineering project of anti-seepage and reinforcement of the dam foundation and its right abutment. (author). 2 refs, 4 figs, 1 tab.

31993 (INIS-mf–11357, pp. 265-276) **Systematic study of distribution characters of infiltration parameters in an experimental basin by nuclear methods.** Gu Weizu (Ministry of Water Resources and Electric Power, Nanjing (China). Nanjing Research Inst. of Hydrology and Water Resources); Lu Jieju; Lu Mingjiang; Chen Tingyang. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

A case study of spatial variability of Philip's infiltration parameters was carried out in a small experimental catchment with an area of 0.8 ha by nuclear monitoring methods. Relationships between sorptivity S, parameter A and the average initial soil water content within 0.5 m depth of soil profiles over the catchment have been plotted. A watershed infiltration parameter distribution curve is set up and fitted approximately by f/F=1-(1-S/S/sub M/)/sup n/. The parameters of composite infiltration response related to whole catchment are suggested. The author has studied it on an experimental basin by combined method of nuclear technology and micro-geomorphic analysis. The results are satisfactory. (author). 6 refs, 11 figs, 2 tabs.

5102 Chemicals Monitoring and Transport

Refer also to citation(s) 31122, 31123, 31167, 31923, 31927, 31935, 31936, 31937, 32029, 32030, 32031, 32032, 32033, 32041, 32042, 32043, 32049, 32358

31994 (CCREM–8809) **National inventory of PCB waste storage sites.** Canadian Council of Resource and Environment Ministers, Downsview, ON (Canada). 1988. 304p. (MICROLOG–89-01180). Available from Canadian Council of Resource and Environment Ministers, 4905 Dufferin St., Downsview, ON, Canada M3H 5T4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

40,000 tonnes of polychlorinated biphenyls (PCBs) were imported into Canada between 1929 and the late 1970s. Federal and provincial governments have identified and tracked the location of askarel fluids that have a 40 to 70% PCB content, and the equipment containing these fluids. Since September 1977, use of PCBs has been severely restricted under the Environmental Contaminants Act. As a result PCB equipment is being replaced through attrition. This inventory represents a "snap shot" of the PCB wastes in storage as of September 1988. The inventory identifies the owner or operator by company name and address, and volumes of waste. It characterizes materials as high concentration, low concentration, or concentration unknown. The volumes of PCBs listed in the attached inventory for each site are the quantities recorded at the time of the last inspection. These data will be modified continuously as new safety inspections are done. Materials listed in the high concentration column include items such as askarel (PCB dielectric fluid), PCB transformers and capacitors (with an indication where possible of whether they are empty or full), and PCB contaminated liquids (where the concentration of PCBs is greater than 500 ppM).

31995 (CONF-890692–5) **Fate and effects of PAHs in the terrestrial environment: An overview.** Edwards, N.T. Oak Ridge National Lab., TN (USA). 1989. 16p. Sponsored by DOE Environment Health & Safety. DOE Contract AC05-84OR21400. From 82. Air and Waste Management Association annual meeting and exhibition; Anaheim, California, USA; 25-30 Jun 1989. Order Number DE89010319/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A recent review of polycyclic aromatic hydrocarbons (PAHs) in the terrestrial environment pointed to the need for more information and a better understanding of factors controlling the fate of PAHs. With ever increasing energy demands by a growing world population, the amount of PAHs released from energy-producing technologies becomes potentially greater. When PAHs are released into the atmosphere in the vapor phase, most are adsorbed to particles (e.g., fly ash). They are also found in solid and liquid wastes from various energy technologies. PAHs that adsorb to particles in the atmosphere may be carried kilometers from the source before being deposited on vegetation and soil. The well-known PAHs such as benzo(a)pyrene (BaP) are innocuous by themselves, but can be biologically activated by enzymes to form epoxides that are carcinogenic and mutagenic. This report summarizes our knowledge about PAHs in the terrestrial environment with emphasis on their fate and effects on vegetation. 45 refs., 2 figs., 3 tabs.

31996 (OE–8809) **Ontario inventory of approved PCB storage sites.** Ontario Ministry of the Environment, Toronto, ON (Canada). 1988. 183p. (MICROLOG–89-01564). Available from Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A listing is presented by region of storage sites for polychlorinated biphenyls in Ontario. The first section of the listing gives the name of the company or institution storing these wastes, the location, and whether the site is a major or minor storage site (i.e. greater or less than one tonne stored). The second section is an inventory of PCB waste in storage, giving company name, site location, type of waste, types of waste containers used, amount of high

concentration and low concentration waste, and estimated total amount of PCB in storage. This inventory shows a total of 20,384 liters of PCB stored in Ontario. Inventories for other Canadian provinces and territories are also inlcuded.

31997 (OE/ARB–218-87) **Effects of acidic precipitation and related pollutants in the terrestrial environment. A program description.** McIlveen, W.D.; Linzon, S.N. Department of the Secretary of State of Canada, Montreal, PQ (Canada). Terminology and Linguistic Services Branch. 1988. 33p. (MICROLOG–89-00127). Available from Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

In order to determine the impact of acid precipitation and related pollutants on the terrestrial environment, to provide documentation for sound abatement strategies where applicable, and to coordinate interagency cooperation, a series of related programs were undertaken in Ontario. This document outlines the objectives and scope of these programs. The primary components of the terrestrial environment are summarized, and a number of study areas and components are identified. Three main areas of study are presented: soil studies, vegetation studies, and forest productivity and decline studies. These areas are divided into subcomponents and the objectives, anticipated results, achievements, and scientific questions that need answering are given for each. These subcomponents include studies involving sampling, mapping, site variability, long-term changes, establishing baseline data, simulated acid rain experiments, remote sensing, and specific tree studies. 2 figs.

31998 (PB–89-161764/XAB) **Radio-frequency enhanced decontamination of soils contaminated with halogenated hydrocarbons.** Dev, H.; Bridges, J.; Sresty, G.; Enk, J.; Mshaiel, N. IIT Research Inst., Chicago, IL (USA). Feb 1989. 175p. Available from NTIS, PC A08/MF A01.

There has been considerable effort in the development of innovative treatment technologies for the cleanup of sites containing hazardous wastes such as hydrocarbons and chlorinated hydrocarbons. Typical examples of such waste material are: chlorinated solvents, polychlorinated biphenyls, waste aviation fuels, gasoline, etc. The feasibility of treating waste sites containing such materials by in-situ radio frequency heating was established by the study through bench- and pilot-scale experiments. A design for an in-situ field test was developed for the treatment of sites containing solvents and aviation fuel. Cost studies were performed to estimate the treatment cost of a system for the decontamination of sites containing fuels, etc.

31999 (PB–89-179014/XAB) **Hazardous-waste land treatment.** Brown, K.W.; Evans, G.B.; Frentrup, B.D.; Anderson, D.C.; Smith, C. Brown (K.W.) and Associates, Inc., College Station, TX (USA). Apr 1983. 702p. Available from NTIS, PC A99/MF E04.

Supersedes PB–81-182107.

This report provides state-of-the-art information on hazardous-waste land treatment units. Information is provided on site selection, waste characterization, treatment-demonstration studies; land-treatment unit design, operation, and closure, and other topics useful for design and management of land treatment units.

32000 (PB–89-860423/XAB) **Leachate treatment. January 1972-April 1989 (Citations from Pollution Abstracts). Report for January 1972-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 68p. Available from NTISPC N01/MF N01.

Supersedes PB–88-860622.

This bibliography contains citations concerning a variety of methods used in the treatment of leachates. Solvent extraction, lagooning, ultrafiltration, and activated sludge are among the techniques considered. Leachate from landfills, coal piles, and chemical wastes is discussed. (This updated bibliography contains 147 citations, 31 of which are new entries to the previous edition.)

32001 (PNL–6862) **40 CFR 265 interim status indicator-evaluation ground-water monitoring plan for the 216-B-63 trench.** Bjornstad, B.N.; Dudziak, S. Pacific Northwest Lab., Richland, WA (USA). Mar 1989. 149p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE89012583/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This document outlines a ground-water monitoring plan for the 216-B-63 trench located in the northeast corner of the 200-East Area on the Hanford Site in southeastern Washington State. It has been determined that hazardous materials (corrosives) were disposed of to the trench during past operations. Installation of an interim-status ground-water monitoring system is required to determine whether hazardous chemicals are leaching to the ground water from beneath the trench. This document summarizes the existing data that are available from near the 216-B-63 trench and presents a plan to determine the extent of ground-water contamination, if any, derived from the trench. The plan calls for the installation of four new monitoring wells located near the west end of the trench. These wells will be used to monitor ground-water levels and water quality immediately adjacent to the trench. Two existing RCRA monitoring wells, which are located near the trench and hydraulically upgradient of it, will be used as background wells. 46 refs., 15 figs., 12 tabs.

32002 (RISO-M–2765) **Environmental aspects. Development of a computer model for environmental impact of energy production.** Energiministeriets Energiforskningsprogram 1985. Miljoe og restprodukter. Christiansen, H.; Danielsen, E.; Haahr Joergensen, K.; Mackenzie, G.A. Risoe National Lab., Roskilde (Denmark). Feb 1989. 50p. (In Danish). Order Number DE89776148/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

Energiministeriets Energiforskningsprogram 1985. Miljoe og restprodukter.; EFP-85.

The computer model ECCES (Environmental Calculations of Consequences from Energy Systems) has been developed under the Danish Energy Ministry's research programme. The present report describes the work carried out during the period 1985-88. The model contains submodels for atmospheric dispersion and deposition of pollutants, soil chemistry and uptake of pollutants in crops. A recent extension to the model allows the effect on forest soils to be modelled in addition to agricultural soils. Dispersion of pollutants from power stations and area sources is calculated by means of a traditional plume model. The soil chemistry model calculates chemical equilibrium between adsorbed and soluble ions in the soil layers. The cation exchange capacity of the soil is separated into a permanent and a pH-dependent part. Ion uptake in crops is assumed to be proportional to the equilibrium concentration in soil water. The report concentrates on the two main activities undertaken during the research programme: improvement of the soil chemistry model and development of the submodel for forest systems. The improvements in the soil chemistry model included the introduction of CO/sub 2/ pressure and temperature dependence. Also described is the experimental verification work carried out during the period which has contributed to improvements in the model. (author) 17 ills., 25 refs.

32003 (SNV–3520) **Sulphate stores and sulphate adsorption capacity of the spodic B horizon of Swedish forest soils.** Noemmik, H.; Larsson, K.; Nilsson, Aa.; Popovic, B.; Clegg, S. National Swedish Environmental Protection Board, Solna (Sweden). 1988. 56p. Order Number DE89766911/JAW. Available from NTIS (US Sales Only), PC A04/MF A01;1.

Soil materials, collected from the spodic horizon of 31 forest sites across Sweden were examined for their content of phosphate-extractable sulphate as well as for the capacity for adsorbing added /sup 35/S-labelled sulphate. It was found that the mean content of extractable SO/sub 4//sup 2-/-S in the uppermost 0-10 cm layer of the spodic horizon amounted to 54 μg/g with a variation range between -1 and 293 μg/g. The highest SO/sub 4//sup 2-/-store registered in the spodic horizon examined amounted to 484 kg S/ha. The extractable sulphate contents were most closely related to the oxalate-, formate- and acetate-extractable Al. The relationship with pH (H/sub 2/O) and organic C content of the soil was non-significant. With a few exceptions the soils indicated a capacity for additional adsorption of sulphate added as /sup 35/S-labelled SO/sub 4//sup 2-/. The mean adsorption capacity was 42 μg/g. The above figure for adsorption capacity increased to 97 μg SO/sub 4// sup 2-/S/g when the pH of the soil-water suspension was lowered

to 3.-3.7. The data presented did not indicate any simple relationships between the soil content of extractable sulphate and the amounts of atmospheric deposition of sulphur on the experimental sites in question. (authors).

32004 (SNV–3552) **Forest liming in small catchment areas. Background information and preliminary results on liming effects 1983-1987.** Nihlgaard, B.; Paalsson, I. National Swedish Environmental Protection Board, Solna (Sweden). Dec 1988. 53p. Order Number DE89766912/JAW. Available from NTIS (US Sales Only), PC A04/MF A01;1.

The acidification of forest and water seems to be continuing with unabated speed. Within the National Swedish Environmental Protection Board (SNV) it has been judged that it is likely that the pH of the forest soils will need to be increased in SW Sweden, so as not to risk long-term negative effects on forest production or massive regional problems with surface water and ground water. In order to quantify how effective different measures against acidification are in larger forest areas, a decision was taken in 1983 by SNV that catchment areas of between 3-50 ha should be treated with wood-ash, K-slag or dolomitic lime. The work within this research project should be regarded in the light of this background. The aim is to study the effects of liming on the soil-, surface- and groundwater, and also on the vegetation and fauna within complete, small but representative catchment areas in Southwestern Sweden, with areas positioned in a north-south gradient. At the same time the effects on forest production is being studied in experimental plots which are not discussed in this report. All of it is long-term studies that will continue for at least 10 years. (authors).

32005 Cadmium and manganese sorption by soil macropore linings and fillings. Turner, R.R. (Oak Ridge National Lab., TN (USA)); Steele, K.F. *Soil Science (USA),* 145(2): 79-86 (Feb 1988). DOE Contract AC05-84OR21400.

The authors collected materials partially filling or coating the walls of soil macropores to compare their sorptivity for cadmium (Cd) and manganese (Mn) with that in homogenized soil samples from the same soil profile. Organic-rich linings and fillings in root-derived soil macropores exhibited higher sorptivities for Cd and Mn that homogenized soil, particularly at lower solution pH values (pH 4 to 5). Due to the higher density of pH-dependent sorption sites on organic matter, sorption on root-derived macropore materials increased more rapidly as pH increased than did sorption on inorganic macropore materials. Inorganic linings and fillings in fracture-derived macropores exhibited sorptivities for Cd and Mn that were very similar to homogenized soil sorptivities. For both organic and inorganic macropore materials, solution pH was generally far more important in determining sorptivity than the nature of the macropore material. Overall, the results of the study suggest that the migration of Cd and Mn will likely be more highly retarded in root-derived macropores than in other types of macropores. The absence of significant differences in sorptivity between inorganic macropore materials and homogenized soil suggests that factors other than sorptivity will be more important in determining whether retardation of Cd and Mn is greater or less in the whole soil matrix than that in non-root-derived macropores.

5103 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 30620, 30621, 30624, 30885, 30918, 30924, 31348, 31937, 32053, 32361, 32362, 32396, 32767, 32959

32006 (CNIC–00175) **Research on the adsorption of technetium and iodine in some minerals.** Zhuang Huie; Zeng Jishu; Zhu Lanying. China Nuclear Information Centre, Beijing, BJ (China). Jan 1988. 8p. (In Chinese). (IAE–0045). Order Number DE89613464/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In order to look for some geologic materials that can retard technetium and iodine, the adsorption and desorption of iodine and technetium on brass ore, lead glance, rare-earth hematite, antimony glance, molybdenite and iron pyrites were studied. The results indicate that brass ore and lead glance have rather good ability of adsorbing iodine (R/sub d/approx.= 100 mL center dot g/sup -1/) and antimony glance for technetium (R/sub d/approx. = 2 x 10/sup 3/mL center dot g/sup -1/). These kinds of adsorptions are't inverse. Adsorbed nuclides were hard kept by those ores.

32007 (FOA-C–20679-9.2) **Resuspension of radionuclides during cultivation. Results from a single sample analysis, Spring 1987.** Finck, R.; Bjurman, B. Foersvarets Forskningsanstalt, Stockholm (Sweden). May 1988. 16p. (In Swedish). Order Number DE89616201/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A measurement of the resuspension of radionuclides during cultivation has been performed at a farm in northern Sweden where the deposition from the Chernobyl accident is high. The resuspension was found to increase 10 to 30 times during cultivation as compared to normal conditions in the same region. It can be estimated that the resuspension could be as high as 3000 times the normal conditions if cultivation is performed directly after fallout during dusty conditions. The resuspension of cesium-nuclides should normally not imply any radiation hazard due to inhalation if the ground deposition is not very high. (authors).

32008 (INIS-BR–1486) **Environment and nuclear war.** Warner, F. Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil). 1988. 6p. (CONF-881289–: 2. week of environment, Piracicaba, Brazil, 5-9 Dec 1988). Order Number DE89613737/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The consequences of a nuclear war, describing the physical effects, the ecological and agricultural effects are presented. (M.C.K.).

32009 (INIS-mf–11435) **Contributions to the study of environmental radioactivity.** Sima, O.A. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 21p. (In Romanian). Order Number DE89616547/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

The results of the author's environmental radioactivity researches are presented.

32010 (OEVS-Mitteilung–1988, pp. 182-186) **Investigations on radon exhalation rates of the soil.** Schuetz, M. (Universitaet des Saarlandes, Homburg/Saar (Germany, F.R.). Inst. fuer Biophysik); Keller, G. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In the south-west Germany the radon 222 exhalation rates from the soil was measured by electrostatic separation. The radon 222 exhalation rate depend on the temperature difference between the soil and air, further on the pore volume filled with water and air, respectively, of the soil. Different geological formations show different exhalation rates. The research project was done by request of the Federal Secretary of State for the Interior under the working title 'Determination of air concentration of radon and its short-lived decay products in dwellings-estimation of the lung dose to the inhabitants'. The responsibility for the content is with the authors. 3 refs., 3 figs.

32011 (OEVS-Mitteilung–1988, pp. 231-238) **Medical radionuclides in the Austrian environment.** Henrich, E. (Umweltbundesamt Wien, Abteilung Strahlenschutz, Vienna (Austria)); Schoenhofer, F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The increasing uses of radionuclides in medical diagnostics and therapy leads to detectable contaminations in the environment. Values for these contaminations and estimates of the monthly throughputs are given. 4 figs., 3 tabs.

32012 (OEVS-Mitteilung–1988, pp. 488-492) **25 years of reference measurements in the Karlsruhe whole-body counter: /sup 137/Cs in man, /sup 60/Co in steel, /sup 226/Ra and /sup 232/Th in paper.** Doerfel, H.R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Two 4NaI(Tl)-detector whole-body counters were used, beginning in 1961 to monitor the activity in a selected ('reference') group of 20 members of the Karlsruhe (FRG) population. The temporal development is correlated with the fallout from the atmospheric nuclear weapon tests, and later from Chernobyl. Of more special interest are measurements of Co-60 in steel where Co-60 wires are used in the production process. Similarly, traces of radium and thorium are introduced into paper during fabrication. Values of activities in steel and paper are presented. 4 refs., 5 figs., 1 tab. (qui).

32013 (OEVS-Mitteilung–1988, pp. 746-755) **Summary of the impact of the Chernobyl release on the Belgian territory.** Govaerts, P. (SCK/CEN, Mol (Belgium)); Fieuw, G. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Most of the measurements were done at Mole: the evolution of beta-dust concentration; the evolution of ambient gamma exposure; the isotopic composition of the airborne concentrations and the integrated deposition of some important radionuclides; the distribution of integrated deposition levels over Belgium; the evolution of /sup 131/I concentration in milk, are shown in figures 1-5. 8 figs. (qui).

32014 (OEVS-Mitteilung–1988, pp. 768-771) **/sup 131/I-activity in man's thyroid and /sup 137/Cs-activity in muscle tissue.** Rabitsch, H. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik); Mueller, H. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

/sup 131/I- and /sup 137/Cs-activities in milk and salad on one hand, and in thyroid - and muscle tissues of deceased persons on the other hand were determined in the days and weeks after the Chernobyl accident around Graz, Austria. The values listed in the tables are intended to investigate radionuclides migration from the food chain to human tissues. 4 tabs. (qui).

32015 (OEVS-Mitteilung–1988, pp. 735-740) **Measurements of the Research Centre Seibersdorf with regard to the reactor accident at Chernobyl.** Mueck, K. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. (Austria). Inst. fuer Strahlenschutz); Hefner, A.; Steger, F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In connexion with the reactor accident at Chernobyl the measurement of the activity concentration in food was alloted to several institutions in Austria. According to its capacities the Austrian Research Centre Seibersdorf had to take the major share. Samples of food and other relevant items from three of the nine provinces and to some degree also from other provinces were measured in the Research Centre. Up to 600 samples daily were evaluated which sometimes required shift operation on the six semiconductor measuring devices employed. The large number of samples enables a fairly good estimate of the dose to the Austrian population due to this accident. The radiation dose in the first year in addition to the natural background dose will on the average amount to: 0,13 mSv external dose; 0,05 mSv inhalation dose (effective dose equivalent); 0,7 mSv ingestion dose (effective dose equivalent). This corresponds to approximately 1/3 of the annual dose due to natural background radiation in Austria. 4 refs., 3 figs., 3 tabs.

32016 (OEVS-Mitteilung–1988, pp. 896-901) **Measurements for the estimation of the external doses in Hungary from Chernobyl release.** Andrasi, A. (Central Research Institute for Physics, Budapest (Hungary)); Deme, S.; Feher, I.; Koblinger, L.; Lancsarics, G.; Lang, E.; Lorinc, M.; Nemeth, I.; Zombori, P.; Tokai, G. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

This paper presents data on external radiation conditions occured due to the accident at the Chernobyl nuclear facility. Measurements were carried out by the Health Physics Department of the Central Research Institute for Physics in cooperation with the Hungarian Civil Defence Organization from Apr 28 to Jun 12, 1986 in Hungary. 10 refs., 7 figs., 1 tab.

32017 (OEVS-Mitteilung–1988, pp. 828-837) **Chernobyl - measurements by the Austrian Environmental Protection Agency.** Henrich, E. (Umweltbundesamt Wien, Abteilung Strahlenschutz, Vienna (Austria)); Schoenhofer, F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In the course of the events after the reactor accident at Chernobyl the radiation protection department of the Austrian Environmental Protection Agency has measured thousands of samples of different origin. This paper gives a short overview over some of the programs helping to determine the impact on the Austrian environment and population. 11 figs., 1 tab.

32018 (OEVS-Mitteilung–1988, pp. 870-874) **Method for the retrospective determination of contamination from the Chernobyl accident. Gamma spectroscopic evaluation of woodpiles.** Scholz, H. (Umweltinstitut Muenchen, Muenchen (Germany, F.R.)); Krueger, E.H. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Due to their vertical drain-structure, wooden posts have a great capacity for retention of pollutants from precipitation. Gamma-spectroscopy measurement of the surface contamination of soil in comparison to the contamination of the wooden posts can be used to determine the retention in wood. In the average we find a retention factor of 0,85 compared to the contamination of the soil. This facilitates the taking of samples. While the results of tests on soil may be subject to changes in activity due to working of the soil, the foilage, slopes etc. fence posts remain in the original condition. 1 ref., 2 figs., 1 tab.

32019 (OEVS-Mitteilung–1988, pp. 890-895) **Measurements on internal contamination in Budapest due to the Chernobyl accident.** Andrasi, A. (Central Research Institute for Physics, Budapest (Hungary)); Beleznay, E.; Feher, I. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress

of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Internal contamination in Budapest residents was investigated by whole body counting following the reactor accident at Chernobyl. Activities of /sup 131/I in thyroid, /sup 103/Ru in lung, /sup 134/Cs and /sup 137/Cs in the total body were measured and the resulted doses were estimated. 4 refs., 5 figs., 2 tabs.

32020 (OEVS-Mitteilung–1988, pp. 885-889) **Radiation burden of soil and vegetation in South Tyrol, Italy, after the Chernobyl accident.** Minach, L. (Chemisches Landeslabor, Autonome Provinz Bozen (Italy)); Brunner, P. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Geographic variations of iodine 131- and cesium 137 contamination in the soil and the vegetation are displayed in a dozen of maps. Attempt is made to correlate the contamination with the precipitation in the period Apr 30 to May 3, 1986. It is concluded that plants take radioactivity mainly through the leaves. 6 figs. (qui).

32021 (ORNL/RASA–88/29) **Results of the independent radiological verification survey of the lower Sheffield Brook floodplain, Wayne, New Jersey.** Yalcintas, M.G.; Carrier, R.F. Oak Ridge National Lab., TN (USA). May 1989. 27p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89012739/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Prior to 1971, the W.R. Grace Company processed and stored radioactive materials at Wayne, New Jersey, under license to the Atomic Energy Commission. Decontamination of structures and storage of waste materials on the property at the Wayne Interim Storage Site (WISS) took place in 1974. Surveys by the State of New Jersey Department of Environmental Protection and by Oak Ridge Associated Universities for the NRC in 1982 indicated that properties adjacent to the WISS contained surface contamination by radioactive residuals in amounts exceeding those acceptable under US Department of Energy (DOE) remedial action guidelines. At the request of DOE, remedial actions have been conducted by Bechtel National, Inc., to remove radioactive residuals from properties adjacent to the site. It is the policy of DOE to assign an independent verification contractor to ensure the effectiveness of remedial actions performed within the Formerly Utilized Sites Remedial Action Program. This report describes the methods and results of those studies that were conducted by the Measurement Applications and Development Group of the Oak Ridge National Laboratory for the lower Sheffield Brook floodplain west of the WISS. Based upon post-remedial action and verification survey data, it was concluded that residual soil concentrations and gamma levels following excavation and backfilling of the area are within the limits prescribed by DOE radiological guidelines. 12 refs., 6 figs., 8 tabs.

32022 (ORNL/RASA–89/2) **Results of the independent verification of radiological remedial action at 480 South Main Street, Monticello, Utah (MS00049).** Crutcher, J.W.; Smuin, M.W. Oak Ridge National Lab., TN (USA). May 1989. 7p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89012756/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In 1980 the site of a vanadium and uranium mill at Monticello, Utah, was accepted into the US Department of Energy's (DOE's) Surplus Facilities Management Program, with the objectives of restoring the government-owned mill site to safe levels of radioactivity, disposing of or containing the tailings in an environmentally safe manner, and performing remedial actions on off-site (vicinity) properties that has been contaminated by radioactive material resulting from mill operations. During 1984 and 1985, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity property at 480 South Main Street, Monticello, Utah. The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory was assigned the responsibility of verifying the data supporting the adequacy of remedial action and confirming the site's compliance with DOE guidelines. The PAG found that the site successfully meets the DOE remedial action objectives. Procedures used by PAG are described. 3 refs., 2 tabs.

32023 **Prediction of radiation effects from proposed low-level waste disposal sites in Turkey.** Fields, D.E. (Oak Ridge National Lab., TN (USA)); Yalcintas, M.G. *Journal of the Tennessee Academy of Science (USA),* 63(2): 52 (Apr 1988). DOE Contract AC05-84OR21400.

PRESTO-II (Prediction of Radiation Exposures From Shallow Trench Operations) computer code is used to assess the risk associated with the shallow land disposal of low level radioactive waste (LLW) in various sites in Turkey. A preliminary simulation using the PRESTO-II computer code has been run for the site in Koteyli-Belikesir and Kozakli-Nevsehir. This example simulation was performed using the same radionuclide data set believed representative of the LLW disposal facility in Barnwell, South Carolina. These simulation results must be generally regarded as estimates based on the assumptions about waste stream composition, disposal methodology, and site geography. Lower consequences are predicted for the Barnwell, South Carolina site and Kozakli-Nevsehir, relative to the Koteyli-Balikesir but this conclusion results largely from the assumption that the Koteyli, Turkey site were not irrigated, predicted consequences for this site would be considerably lessened. Preliminary simulations have been performed of release and transport of radionuclides from a proposed low-level radioactive waste disposal site in Turkey. The authors expect that the results of these simulations will be useful in providing estimates of the consequences of alternative disposal sites and practices.

32024 **Correlation between thorium concentrations in soil and gamma readings in FUSRAP site in New Jersey.** Yalcintas, M.G. (Oak Ridge National Lab., TN (USA)); Fields, D.E.; Uslu, I. *Journal of the Tennessee Academy of Science (USA),* 63(2): 51 (Apr 1988). DOE Contract AC05-84OR21400.

Thorium ores were processed in Wayne and Maywood, New Jersey, between 1916 and 1956. During the course of Th processing, the wastes from the operations were pumped into dikes next to the plant. Construction in the area caused the dispersal of waste into adjacent areas. The Department of Energy (DOE) adopted a policy of assigning an independent verification contractor to ensure the effectiveness of remedial action performed within the Formerly Utilized Sites Remedial Action Program (FUSRAP). The Environmental assessment group of Oak Ridge National Laboratory was assigned the responsibility for this task at the Maywood and Wayne, New Jersey sites. The soil samples collected from the area were analyzed to determine the thorium concentration. In this study, a correlation is described between the thorium concentration and the gamma readings of the site. The statistical analysis of the data indicates that this correlation is site-specific and depends on the depth of the radionuclide. Data will be presented, and the method of analysis is described.

5104 Thermal Effluents Monitoring and Transport

Refer also to citation(s) 30941

5105 Site Resource and Use Studies

Refer also to citation(s) 30514

32025 (CONF-851069–1) **An analysis of soil and surface properties which affect infiltration and runoff on mined lands, Centre County, Pennsylvania.** Jorgensen, D.W.; Gardner, T.W. Pennsylvania State Univ., University Park, PA (USA). 1985. 23p. Sponsored by DOE Energy Research. DOE Contract FG02-84ER60263. From Wetlands and water management on mined lands conference; University Park, Pennsylvania, USA; 23-24 Oct 1985. Order Number DE89012392/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Seventy-eight dripping rainfall simulator tests were performed on one- to four-year-old topsoiled areas of five surface coal mines. The

data set consists of soil/surface properties and runoff volumes fit to the Horton infiltration equation. Systematic changes in infiltration through time necessitate an analysis of these variables grouped by age. In general, r-values increase when correlation matrices are divided by age. Few significant correlations exist between soil/surface properties and infiltration for newly reclaimed soils. However, correlations increase in number and strength with increasing soil age. Multiple regressions are used to explore relationships between infiltration parameters and soil/surface properties at each year. Regression models of 30-min infiltration volume and steady-state rate consistently include percent silt and clay, slope, bulk density, and vegetation. Mean infiltration volumes at different mines are initially equal, but become significantly different with surface age. The magnitude of the increase is controlled by the soil texture, vegetation, slope, and bulk density. 25 refs., 9 figs., 6 tabs.

32026 (CONF-890207–30) **Expediting cleanup at the Weldon Spring site under CERCLA and NEPA.** Peterson, J.M.; MacDonell, M.M.; Haroun, L.A.; McCracken, S.H. Argonne National Lab., IL (USA). [1989]. 8p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Waste management '89; Tucson, Arizona, USA; 26 Feb - 2 mar 1989. Order Number DE89012384/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Weldon Spring Site Remedial Action project is being conducted under the Surplus Facilities Management Program of the US Department of Energy (DOE). The DOE has developed an environmental compliance strategy for this project to meet the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Environmental Policy Act (NEPA). A key element of this strategy was the development of an integrated CERCLA/NEPA process to minimize, to the extent possible, the need to prepare duplicate documentation. Additionally, the project is implementing various expedited response actions to mitigate actual or potential uncontrolled releases if radioactively or chemically hazardous substances to the environment and to minimize potential health and safety risks to on-site personnel and local human and biotic populations. These actions are being conducted concurrently with the preparation of major environmental compliance documentation. The initiation of site cleanup via these response actions has fostered a very positive relationship with the US Environmental Protection Agency Region VII, the state of Missouri, and the affected public. 2 refs., 3 figs.

32027 (DOE/SR/15191–2) **Wildlife management assistance report: Progress report, July 1, 1988–June 30, 1989.** Caudell, M.B. South Carolina Wildlife and Marine Resources Dept., Columbia, SC (USA). May 1989. 3p. Sponsored by DOE Defense Programs. DOE Contract FC09-87SR15191. Order Number DE89012377/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Thirty-four days were spent administering hunts on Crackerneck Wildlife Management Area with approximately 1100 people participating. Biological data was collected and evaluated on 50 deer, 3 wild turkeys, 16 feral hogs, 16 ducks of two species, 85 gray squirrels, and 105 fish of 4 species. Preparatory work prior to hunts included 4 miles of roadways being fertilized and 3 miles of roads brushed. Approximately 200 WMA and 20 US Government signs were posted on the area. Serving as a Coordinating Land User for the SRP site use Committee entailed evaluating 45 land use proposals with regard to effects on wildlife populations. Eight timber prescriptions proposed by the US Forest Service were the most time consuming involving records review, field investigations, meetings with the authoring agency, and a report to DOE detailing possible impacts. The Natural Resources Management draft plan required attendance at several meetings and an extensive written review of impacts. DOE was provided with information on how state game laws apply to research involving animal collection and SRP deer hunts. Trapping permits were issued to the beaver control contractor when required.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

Refer also to citation(s) 31898, 32439

32028 (FO/CAR–1614) **Phytoplankton primary production and related limnological data for lakes and channels in the Mackenzie Delta and lakes on the Tuktoyaktuk Peninsula, N.W.T.** Fee, E.J.; Hecky, R.E.; Guilford, S.J.; Anema, C.; Mathew, D.; Hallard, K. Department of Fisheries and Oceans, Winnipeg, MB (Canada). Central and Arctic Region. 1988. 70p. (MICROLOG–89-01211). Available from Canada Dept. of Fisheries and Oceans, Scientific Info. & Pubs. Branch, 200 Kent Street, 14th. Floor, Ottawa, ON, Canada K1A 0E6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

The Mackenzie Delta region supports an important domestic fishery based on broad whitefish and associated species. Industrial developments, particularly oil and gas activities in the Beaufort Sea, but also proposed hydroelectric developments on the Liard River, could severely impact those fish populations in the next decade. In order to be able to control these impacts, information on the ecology of aquatic habitats of these species is needed. The limnological characteristics of lakes and channels in the Mackenzie Delta and lakes in the Kukjuktuk (Tuktoyaktuk Peninsula) were studied during the open-water seasons of 1985 and 1986. Detailed descriptions of the study sites, sampling procedures, and laboratory methods are given. Data on the following variables are presented: temperature, pH, oxygen (concentration and percent saturation), specific conductance, Secchi disk transparency, extinction coefficient, percent reflectance, total inorganic carbon concentration, chlorophyll-a concentration, and phytoplankton photosynthesis parameters. Ice-free season integral phytoplankton primary production rates were similar in the two study areas; these differences are unlikely to be an important factor causing migration of whitefish from the Mackenzie Delta to the Kukjuktuk lakes. Limnological properties showed much greater variation from 1985 to 1986 in the Kukjuktuk lakes than in the Delta lakes. The Delta lakes probably have less year-to-year variability than the lakes on the Tuktoyaktuk Peninsula because: ice-out in the Delta lakes is caused by flooding of the Mackenzie River instead of by melting of the ice, so it occurs in a narrower window of time; and chemical and physical conditions in the Delta lakes are reset to a similar starting point each year when the Mackenzie River floods. 16 refs., 37 figs., 6 tabs.

5202 Chemicals Monitoring and Transport

Refer also to citation(s) 30275, 30298, 31167, 31429, 31446, 31450, 31935, 31936, 31937, 32000

32029 (AD-A–204382/6/XAB) **Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987.** CH2M Hill, Gainesville, FL (USA). Nov 1988. 144p. Available from NTIS, PC A07/MF A01.

See also Appendices, Volume 1, AD-A204 383.

This Phase II, Stage 2 Installation-Restoration Program Confirmation/Quantification survey for Moody Air Force Base, Georgia investigated four sites: Site 1, Southwest Landfill; Site 2, an underground waste-fuel storage area; Site 3, the flight-line storm-drainage outfall area; and, Site 4, the Moody AFB water-supply well at the Grassy Pond annex. Sites 1 and 4 required additional investigation as a result of the Phase II, Stage 1 investigation conducted in 1985. Sites 2 and 3 were investigated for the first time during this Stage 2 effort. The scope of work consisted of conducting hydrogeologic investigations at sites 1 and 2, and water-quality sampling and analyses at sites 1,2,3,4. Three deep (80 feet) wells and six shallow (30 feet) wells were installed around the perimeter of the Site 1 landfill. Seven temporary well points, one standard penetration test boring, and four shallow monitor wells (30 feet) were installed at the Site 2 waste-fuel storage area. Groundwater quality samples were collected from all of the new wells at Site 1 and 2, from two of the existing monitor wells at the Site 1 landfill, and from Moody water supply well No. 7 near Site 1. Water level, organic vapor, and

floating-product thickness measurements were performed on the temporary well points at Site 2.

32030 (AD-A–204383/4/XAB) **Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987.** CH2M Hill, Gainesville, FL (USA). Nov 1988. 347p. Available from NTIS, PC A15/MF A01.

See also Appendices, Volume 2, AD-A204 384.

This Phase II, Stage 2 Installation-Restoration Program Confirmation/Quantification survey for Moody Air Force Base, Georgia investigated four sites: Site 1, Southwest Landfill; Site 2, an underground waste-fuel storage area; Site 3, the flight-line storm-drainage outfall area; and, Site 4, the Moody AFB water-supply well at the Grassy Pond annex. Sites 1 and 4 required additional investigation as a result of the Phase II, Stage 1 investigation conducted in 1985. Sites 2 and 3 were investigated for the first time during this Stage 2 effort. The scope of work consisted of conducting hydrogeologic investigations at Sites 1 and 2, and water-quality sampling analyses at Sites 1, 2, 3, and 4. Three deep (80 feet) wells and six shallow (30 feet) wells were installed around the perimeter of the Site 1 landfill. Seven temporary wellpoints, one standard penetration test boring, and four shallow monitor wells (30 feet) were installed at the Site 2 waste-fuel storage area. Groundwater quality samples were collected from all of the new wells at Sites 1 and 2, from two of the existing monitor wells at the Site 1 landfill, and from Moody water supply well No. 7 near Site 1. Water level, organic vapor, and floating-product thickness measurements were performed on the temporary wellpoints at Site 2.

32031 (AD-A–204384/2/XAB) **Installation restoration program. Phase 2. Confirmation/quantification stage 2, Moody Air Force Base, Georgia. Appendices. Volume 2. Final report, October 1986-November 1987.** CH2M Hill, Gainesville, FL (USA). Nov 1988. 267p. Available from NTIS, PC A12/MF A01.

Appendices to AD-A204 382.

This Phase II, Stage 2 Installation-Restoration Program Confirmation/Quantification survey for Moody Air Force Base, Georgia investigated four sites: Site 1, Southwest Landfill; Site 2, an underground waste-fuel storage area; Site 3, the flight-line storm-drainage outfall area; and, Site 4, the Moody AFB water supply well at the Grassy Pond annex. Sites 1 and 4 required additional investigation as a result of the Phase II, Stage 1 investigation conducted in 1985. Sites 2 and 3 were investigated for the first time during this Stage 2 effort. The scope of work consisted of conducting hydrogeologic investigations at Sites 1 and 2, and water quality sampling analyses at Sites 1, 2, 3, and 4. Three deep (80 feet) wells and six shallow (30 feet) wells were installed around the perimeter of the Site 1 landfill. Seven temporary wellpoints, one standard penetration test boring, and four shallow monitor wells (30 feet) were installed at the Site 2 waste-fuel storage area. Ground-water quality samples were collected from all of the new wells at Sites 1 and 2, from two of the existing monitor wells at the Site 1 landfill, and from Moody water-supply well No. 7 near Site 1. Water level, organic vapor, and floating-product thickness measurements were performed on the temporary wellpoints at Site 2.

32032 (AD-A–204620/9/XAB) **Installation-Restoration Program. Phase 2. Confirmation/quantification stage 1 for Minot Air Force Base, Minot, North Dakota. Volume 2. Appendices A through F. Final report, September 1985-October 1988.** Hart (Fred C.) Associates, Inc., New York, NY (USA). Oct 1988. 163p. Available from NTIS, PC A08/MF A01.

See also Volume 1, AD-A204 461.

This document in the appendices A-F for the Installation-Restoration Program Report concerning Minot Air Force Base. The overall objective of the Installation Restoration Program (IRP) Phase II investigation is to assess potential contamination at past hazardous-waste-disposal and spill sites on Air Force installations. A series of stages field investigations may be required to meet this objective. The purpose of this task is to undertake a field investigation at Minot AFB ND to: (1) confirm the presence or absence of contamination within the specified areas of investigation: (2) if possible, determine the extent and degree of contamination and the potential for migration of those contaminants in various environmental media; (3) identify public health and environmental hazards of migrating pollutants based on State or Federal standards for those contaminants; and (4) delineate additional investigations required beyond this stage to reach the Phase II objectives.

32033 (DPST–89-359) **A mathematical model of fluid flow in the vicinity of a horizontal air-injection well.** Haselow, J.S. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. 13 Mar 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. Order Number DE89013471/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A simplified numerical modeling study of the horizontal air injection well has been completed. The model was used to determine the effects of air injection on the flow paths of water in the vicinity of horizontal well. Flow paths of water change as the injected air displaces in-place water and subsequently changes the relative permeability of the soil to water. The results of the modeling effort indicate that in the vicinity of the well the potential for gross changes in the flow paths exists. Fluid flow perpendicular to the horizontal well is almost completely diverted around the well for most realistic changes in the relative permeability due to air injection. However, flow only a short distance away (approximately 100 ft) from the air injection well is relatively unaffected. 2 refs., 7 figs., 1 tab.

32034 (EC/IWD–1988) **Studies of the Ionic balance of Laflamme Lake in 1985 and 1986.** Papineau, M. Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate. 1988. 122p. (In French). (MICROLOG–89-00454). Available from Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Results obtained during two years of a study of the effects of long range transport on the ion budget of a Quebec lake are presented. In 1985, it was shown that the lake has continued to be exposed to acid precipitation. The 1.3 m layer of lake water with an average pH of 4.3 has contributed 23 kg/hectare of wet sulfate to the basin. In contrast to other North American sites, the lake did not seem to be in a situation of reduced atmospheric inputs from 1981 to 1985. The first indications on precipitation quality in 1986 tend to indicate a lowering of acidifying inputs but this situation may simply be the result of the special weather conditions in 1986. The atmospheric contributions continue to bring about short term acidifications during spring melt and heavy rains. In the longer term, changes in surface waters between 1981 and 1986 have been a significant increase in sulfates, in trace metals (Fe, Al) and decreases in sodium and alkalinity. This important decrease in alkalinity has led to a shift from a calcium bicarbonate system to a calcium sulfate system. Another important phenomenon in the lake basin is a decrease in concentrations and exports of nitrates and hydrogen ions in the surface waters since 1982. Decreases in pH during spring melt also seem less pronounced. Some interesting changes have occurred in surface water quality in 1986: tendencies to an increase in sulfates and aluminium are reversed and the pH of the waters has increased resulting in an autumnal pH 0.3 higher than the seasonal average. 18 refs., 22 figs., 27 tabs.

32035 (EPRI-EA–5818-Vol.1) **Chemical data for predictinng the fate of organic compounds in water: Volume 1, Technical basis: Final report.** Gherini, S.A.; Summers, K.V.; Munson, R.K.; Mills, W.B. Electric Power Research Inst., Palo Alto, CA (USA); Tetra Tech, Inc., Lafayette, CA (USA). c Jun 1989. 187p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

In 1987, EPRI's Land and Water Quality Studies Program initiated a multi-phase project entitled "Environment Behavior of Organic Substances". The objectives of this project are to develop data and methods for predicting the release, transport, transformation, and fate of organic compounds. Tetra Tech was contracted to compile and evaluate available data for 53 organic compounds. The chemicals include polycyclic aromatic hydrocarbons, monocyclic aromatics, heterocyclics, and halogenated aliphatics. The types of data compiled for each compound include physical and thermodynamic properties, equilibrium coefficients (for acid-base dissociation and adsorption-desorption), and reaction rate constants (for volatilization, hydrolysis, photolysis, and biotransformation). Data were evaluated for over 330 experiments described in about 250

references. The values selected were entered into an interactive data base management system. This report is the first volume of a two-volume series. It describes the physical and chemical properties compiled and the relative importance of the different transformation processes influencing the environmental fate of the compounds. Methods used to evaluate the data are discussed along with the methods used to estimate some of the data not available in the literature. Guidance and examples are presented on how the data can be used to estimate concentrations of organic compounds in surface and groundwater. 342 refs., 39 figs., 13 tabs.

32036 (LA-UR–89-1503) **The destruction of hazardous chemical waste by oxidation in supercritical water.** Rofer, C.K.; Streit, G.E. Los Alamos National Lab., NM (USA). 1989. 25p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890575–2: Symposium on emerging technologies for hazardous waste treatment, Atlanta, Georgia, USA, 1-4 May 1989). Order Number DE89012595/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The chemistry of oxidation in supercritical water is being investigated for development into a practical destruction process for hazardous chemical waste. In principle, a wide variety of waste streams might be treated by this technology, including those that are unsuitable for incineration because of high water content. To establish a basis for extrapolation of kinetic measurements to a variety of compounds, a mechanism is being developed for oxidation in supercritical water on the basis of conventional free-radical reactions, with modifications for high pressures and high concentrations of water. Global rate expressions for oxidation of methane and methanol in supercritical water have been determined. A base mechanism and modifications to the mechanism to account for the roles of hydrogen bonding and water dimer formation have been investigated for CO. On this limited basis, reasonable agreement between model and experimental results has been obtained. Further verification of the model with experimental results will provide insight into the roles of hydrogen bonding and water dimer formation in oxidation in supercritical water. 30 refs., 3 tabs.

32037 (ORNL/TM–10735) **An orthogonal collocation approach to modeling multicomponent adsorption in carbon beds.** Harris, M.T.; Byers, C.H. Oak Ridge National Lab., TN (USA). May 1989. 67p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89012819/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A multicomponent, packed-bed, adsorption model which solves simultaneously for the adsorption of any number of adsorbing components in a bed or slab configuration is presented for predicting breakthrough curves of trace organics in water. Generally it may be directly applied to interacting systems in which there are two interacting adsorbed species in an inert solvent. The model assumes isothermal conditions and that axial dispersion is negligible. It is also proposed that a linear rate model can be used to describe the rate of adsorption of material on the adsorbent, although the method has been shown to apply to more complex situations. The model was tested by comparing predicted bed exit profiles with experimental data for the adsorption of trace amounts of 2-butanol and t-amyl alcohol on a bed of carbon. The applicability of the method to a broad range of adsorption problems in waste disposal and the process industries is discussed. 20 refs., 7 figs.

32038 (ORNL/TM–11135) **Sources and areal distribution of trace metals in recent sediments of Middle Loch, Pearl Harbor (Hawaii).** Ashwood, T.L.; Olsen, C.R.; Larsen, I.L. Oak Ridge National Lab., TN (USA). May 1989. 64p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. Order Number DE89012817/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3274.

The primary objective of this project was to determine whether current operations of the Naval Inactive Ships Maintenance Facility contribute significant trace metal contamination to Middle Loch of Pearl Harbor. Secondary objectives were (1) to identify and quantify all major sources of trace metal contamination in Middle Loch and (2) to determine if trace metal concentrations in Middle Loch have declined following termination of direct discharges from the Pearl City Sewage Treatment Plant. Sediment samples from ten locations within Middle Loch and from two locations in each of the two major streams entering the loch were analyzed for radioisotopes and metals. Major elements (aluminum and calcium) as well as organic and inorganic carbon were used to help characterize sediment composition and source. High aluminum-to-calcium ratios and high organic carbon concentrations are associated with terrigenous material carried into Middle Loch by the streams. The presence of the natural, short-lived (53-d half-life) radioisotope ^{7}Be was used to identify sites where the sedimentary material was recently deposited (i.e., within the past 3 months) and to identify patterns of recent sediment accumulation. Beryllium-7 was detected at eight of the ten sample sites within Middle Loch and in all stream samples. High ^{7}Be inventories beneath the ships and at the mouths of the streams suggest that these are areas of rapid sediment accumulation, or sediment focusing. The concentrations of ^{7}Be closely match the expected input based on rain-bucket data. This suggests that Middle Loch effectively traps all the ^{7}Be through adsorption onto suspended matter and deposition to the sediments. 14 refs., 10 figs., 8 tabs.

32039 (PB–89-156640/XAB) **Chesapeake Bay mainstem monitoring program statistical and analytical support contract: final report, Volume 1.** Martin Marietta Environmental Systems, Columbia, MD (USA). Sep 1987. 59p. Available from NTIS, PC A04/MF A01.

See also PB–89-156657.

The primary focus of this contract was the development of a statistical analysis framework for detection of trends in Chesapeake Bay water quality attributable to pollution-control-management actions. The report found that, while there are aspects of the main Bay water-quality monitoring program that can be improved, the overall approach of the program is sound and will provide the empirical information needed to characterize and detect trends in Chesapeake Bay water quality and to evaluate the effectiveness of management actions. Continuation of this coordinated monitoring effort provides the best opportunity for generation of rigorous statements concerning the State-of-the-Bay and for the development of an ecologically sound water-quality management strategy.

32040 (PB–89-156657/XAB) **Chesapeake bay mainstem monitoring program statistical and analytical support contract: final report, volume 2.** Martin Marietta Environmental Systems, Columbia, MD (USA). Sep 1987. 481p. Available from NTIS, PC A21/MF A01.

See also PB–89-156640.

The primary focus of this contract was the development of a statistical analysis framework for detection of trends in Chesapeake Bay water quality attributable to pollution-control-management actions. The report found that, while there are aspects of the main Bay water-quality monitoring program that can be improved, the overall approach of the program is sound and will provide the empirical information needed to characterize and detect trends in Chesapeake Bay water quality and to evaluate the effectiveness of management actions. Continuation of this coordinated monitoring effort provides the best opportunity for generation of rigorous statements concerning the State-of-the-Bay and for the development of an ecologically sound water-quality management strategy.

32041 (PB–89-158604/XAB) **Analytical procedures for environmental quality control. Volume 1. Technical report.** Wang, L.K.; Wang, M.H.S. Lenox Inst. for Research, Inc., MA (USA). 15 Jan 1989. 279p. (LIR–01-89/331). Available from NTIS, PC A13/MF A01.

See also Volume 2, PB–89-158612.

This report covers fourteen important documents. Some examples are: Analysis of trihalomethanes in drinking water; Methods for the determination of organic compounds in finished drinking water and raw source water; Direct measurement of volatile organic compounds in breathing-zone air, drinking water, breath, blood, and urine; Techniques to determine a company's ability to conduct a quality stack test; Laboratory evaluation of Level One organic analysis procedures; Application of methods 606 and 608 for analysis of PCB, organochlorine pesticides and phthalate esters contained in landfill leachates; Method development for determination of polychlorinated hydrocarbons in municipal sludge; Application and determination of organic polymers; A test method for analyzing anionic or cationic surfactants in industrial water.

32042 (PB–89-158612/XAB) **Analytical procedures for environmental quality control. Volume 2. Technical report.** Wang, L.K.; Wang, M.H.S. Lenox Inst. for Research, Inc., MA (USA). 15 Jan 1989. 274p. (LIR–01-89/332). Available from NTIS, PC A12/MF A01.

See also Volume 1, PB–89-158604, and Volume 3, PB–89-158620.

This report covers sixteen important documents. Some examples are: The determination of the maximum total trihalomethane potential; Nationwide approval of alternative test procedure for analysis of trihalomethanes; Volatile organic compounds in eater by purge and trap capillary column gas chromatography with photoionization and electrolytic conductivity detectors in series; Analysis of organohalide pesticides and arclors in drinking water by microextraction and gas chromatography; Testing for lead in school drinking water; Simplified methods for food and feed testing; Determination of nitroaromatic compounds and isophorone in industrial and municipal wastewaters; Sampling for giardia and/or cryptosporidium; determination of TCDD in industrial and municipal wastewaters; Determination of volatile organics in industrial and municipal wastewaters; Determination of polynuclear aromatic hydrocarbons in industrial and municipal wastewaters.

32043 (PB–89-158620/XAB) **Analytical procedures for environmental quality control. Volume 3. Technical report.** Wang, L.K.; Wang, M.H.S. Lenox Inst. for Research, Inc., MA (USA). 15 Jan 1989. 215p. (LIR–01-89/333). Available from NTIS, PC A10/MF A01.

See also Volume 2, PB–89-158612.

This report covers ten important documents: (1) Procedure for determination of total trihalomethane formation potential; (2) Trihalomethane formation potential; (3) Summary of code revision; MCL of organic contaminants and determination of compliance; (4) Sampling, exposure, and analysis of samples; (5) Statewide screening of municipal-sewage discharges initial assessment: chemical and toxicological characterization; (6) Determination of nitrosamines in industrial and municipal wastewaters; (7) Determination of benzidines in industrial and municipal wastewaters; (8) Determination of polychlorinated biphenyls (PCB) in potable water, fish, and sediment; (9) Specialty environmental GC columns: EPA methods and dioxin columns; and (10) VOC detection-limit requirements of large water utilities.

32044 (PB–89-161517/XAB) **Evaluation of the secondary effects of air stripping.** Umphres, M.D.; Van Wagner, J.H. Montgomery (James M.) Consulting Engineers, Inc., Pasadena, CA (USA). Montgomery Labs. Mar 1989. 99p. Available from NTIS, PC A05/MF A01.

At a 2.9 million gallon per day well contaminated with several volatile organic compounds (VOCs), principally trichloroethylene (TCE), a packed-tower aerator (PTA) was pilot-tested, designed, constructed, and monitored during its first seven months of operation. Pilot testing was based on gas/liquid mass transfer theory. Calculated mass transfer coefficients coupled with this theory were used to design the full-scale aerator for TCE control. In addition to liquid-phase VOCs, other parameters including bacteria, temperature, pH, dissolved oxygen, calcium, alkalinity, turbidity, particle counts, noise, and air-phase VOCs were monitored to assess the secondary effects of aeration.

32045 (PB–89-163281/XAB) **Contribution of atmospheric nitrate deposition to nitrate loading in the Chesapeake Bay. Final report.** Tyler, M. Versar, Inc., Columbia, MD (USA). Dec 1988. 37p. Available from NTIS, PC A03/MF A01.

Recent studies have suggested that nitrate introduced into the Chesapeake Bay via atmospheric deposition may be a significant source of excess nutrients. In order to determine if concerns about atmospheric deposition are justified, modeled estimates of wetfall nitrate deposition over the Chesapeake Bay basin, based on monitoring data collected in 1984, were used to estimate basin-wide nitrate loading (1.38×10^8 kg) over the land area of the basin. Estimates of transfer coefficients and nitrate loadings to the Bay for various land-use categories were also calculated, using figures developed by the EPA Chesapeake Bay Program. The conservative nature of assumptions made in developing these figures suggests that the actual percentage contribution of atmospheric nitrate deposition may be lower than the estimated value.

32046 (PNL–6883) **Biological testing of sediment for the Olympia Harbor Navigation Improvement Project, 1988: Geoduck, amphipod, and echinoderm bioassays.** Ward, J.A.; Word, J.Q.; Antrim, L.D. Pacific Northwest Lab., Richland, WA (USA). May 1989. 91p. Sponsored by Department of Defense. DOE Contract AC06-76RL01830. Order Number DE89011355/JAW. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

The Olympia Harbor Navigation Improvement Project requires the dredging of approximately 330,000 cubic yards (cy) of sediment from the harbor entrance channel and 205,185 cy from the turning basin. Puget Sound Dredged Disposal Analysis (PSDDA) partial characterization studies were used to plan a full sediment characterization in which chemical analyses and biological testing of sediments evaluated the suitability of the dredged material for unconfined, open-water disposal. The US Army Corps of Engineers (COE), Seattle District, contracted with NOAA/NMFS, Environmental Conservation Division, to perform the chemical analysis and Microtox bioassay tests, and with the Battelle/Marine Sciences Laboratory (MSL) in Sequim to perform flow-through solid-phase bioassays utilizing juvenile (8 to 10 mm) geoduck clams, Panopea generosa, and static solid phase bioassays using the phoxocephalid amphipod, Rhepoxynius abronius, developing embryos and gametes of the purple sea urchin, Strongylocentrotus purpuratus, and the larvae of the Pacific oyster Crassostrea gigas. When the results of the biological tests were evaluated under PSDDA guidelines, it was found that all the tested sediment treatments from Olympia Harbor are suitable for unconfined open-water disposal. 14 refs., 12 figs., 3 tabs.

32047 (STE–55) **Sewage waste discharge to the arctic marine environment.** Stanley Associates Engineering Ltd., Yellowknife, NT (Canada). 1987. 141p. (MICROLOG–89-01939). Available from Indian and Northern Affairs Canada, Reference Centre, Les Terrasses de la Chaudier, Ottawa, ON, Canada K1A 0H4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A study was conducted to provide a data base to assist in the clarification of environmental issues related to the discharge of sewage effluents to Arctic marine environments. Another study objective was to develop a knowledge base on various sewage treatment options under Arctic and High Arctic conditions. Specific objectives included evaluation of treatment systems that could be applied to offshore industrial activities such as oil and gas production. An introductory review is first presented of regulatory practices and policies, mainly in Canada. Current sewage treatment practices in the Canadian north are summarized, along with the characteristics of typical waste waters. The most common form of sewage handling has consisted simply of corse solids screening or maceration followed by direct discharge. Secondary treatment alternatives are described, such as lagoons, activated sludge processes, and fixed film systems. In most oil and gas camps, package sewage treatment plants are most frequently used, and most commonly contain some form of extended aeration system. Problems with these systems and design considerations for optimal treatment are outlined. Finally, the general environmental setting of Arctic marine waters and the impact of sewage discharges are assessed. Potential concerns were revealed, such as a decrease in dissolved oxygen, accumulation of organic particulates, and toxicity of sewage to marine organisms. For the most part, discussion of these impacts relies primarily on results extrapolated from other marine environments located in temperate zones. Recommendations are made on regulatory policies and guidelines, and for practicable sewage treatment technology. 188 refs., 8 figs., 11 tabs.

32048 Kinetic studies of cadmium and ferricyanide adsorption on goethite. Theis, T.L. (Clarkson Univ., Potsdam, NY (USA)); Iyer, R.; Kaul, L.W. *Environmental Science and Technology (USA)*, 22(9): 1013-1017 (Sep 1988). DOE Contract AC02-79EV10253.

Batch and dynamic column methods were used to investigate the sorption rates of ferricyanide ion and cadmium on goethite under constant-pH conditions. Results indicated the rate of adsorption for ferricyanide to be limited by surface mass transfer. Analysis of column data showed mass transfer to be rate limiting during initial adsorption of cadmium and a secondary reaction to be rate limiting

overall with a forward conditional rate constant of 3.0±2 x 10^{-3} L mol^{-1} s^{-1}. Total reactive surface site density for cadmium agreed well with the value obtained from more dilute batch studies. In contrast, the data for ferricyanide showed a single-reaction approach to be sufficient; however, the batch-derived site density was substantially greater than that obtained from the column. These results are discussed in view of the surface-bonding character of these solutes, and implications for laboratory-generated partitioning data are examined.

32049 Comparison of laboratory performances. Einerson, J.H. (Sandia National Labs., Albuquerque, NM (USA)); Pei, P.C. *Environmental Science and Technology (USA),* 22(10): 1121-1125 (Oct 1988).

At Sandia National Laboratories in Albuquerque, NM, accurate and precise data are essential for managing our environment programs. Because we seek high credibility of laboratory data, a study was conducted to determine the management of measurement accuracy and precision by commercial laboratories. This article describes some procedures that will help identify those laboratories that provide precise and accurate analytical services on a consistent basis.

5203 Radioactive Materials Monitoring and Transport

Refer also to citation(s) 30621, 30623, 30624, 30887, 31927, 32015, 32959, 32962

32050 (ANSTO/E–680) **Tritium activity in Australian rainwater 1962-1986.** Calf, G.E. Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Jul 1988. 14p. Order Number DE89616248/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Atmospheric tritirecipitated in rainfall has been measured since 1962 in samples from a network of Australian monitoring stations. Atmospheric thermonuclear bomb tests have injected into the atmosphere about 350 kg of tritium, mostly into the northern hemisphere's troposphere and stratosphere, causing atmospheric concentrations of tritium to reach peak values of 50 to 100 tritium units (TU) in the southern hemisphere. Tritium from underground testing has not contributed significantly to the amounts in the atmosphere or in surface waters. In Australia, peak concentrations of precipitated tritium were observed in 1962, 1964 and 1969. The tritium activity in rainwater for all Australian stations decreased after 1969. Radioactive decay of bomb tritium will decrease the tritium budget to the natural level by the early 1990s in Australian precipitation.

32051 (DOE-RW–88.109) **Geochemistry and mobility of the lanthanides in marine sediments.** Elderfield, H. Department of the Environment, London (UK). Jul 1988. 21p. Order Number DE89616249/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A study has been made to evaluate lanthanide mobility in sediments directly by measuring concentrations of 10 lanthanide elements in sediments and pore waters. Due to the very low concentrations of the lanthanides in sea water relative to marine sediments, evidence of lanthanide mobilization is usually difficult to detect from studies of solid-phase geochemistry. Results show that the lanthanides can be extremely mobile. Concentrations in pore waters up to 100 times sea water concentrations have been measured. The conclusions are tentative but the present data suggest that the lanthanides are mobilized during oxidation of organic-rich sediments and are relocated in part in association with secondary Fe-rich phases. The behaviour of Ce is, predictably, somewhat different from the other lanthanides and may be more mobile as a consequence of its redox chemistry.

32052 (DPST–88-324-Rev.1) **Evaluation of stream biological communities in nonthermal reaches of Four Mile Creek: Revision 1.** Gladden, J.B. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab. Mar 1989. 13p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. Order Number DE89013472/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Available biological data on macroinvertebrate and fish communities in nonthermal reaches of Four Mile Creek were evaluated to determine whether outcropping of effluents from the F- and H-Area seepage basins has adversely affected instream communities. The available data were not adequate to evaluate possible local effects associated with the outcropping zones into Four Mile Creek. However, the cumulative effects of the seepage basin effluent outcropping and all other effluent releases into the upper reaches of Four Mile Creek do not appear to have resulted in deleterious changes in either macroinvertebrate or fish communities. 7 refs., 3 tabs.

32053 (HW–23642) **A statistical analysis of measured river contamination at selected shoreline locations.** Pilcher, G.E. General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation. 27 Feb 1952. 12p. Sponsored by DOE Environment Health & Safety. DOE Contract AC06-76RL01830. Order Number DE89013132/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Declassified 14 June 1989.

The amount of contamination in the Columbia River below Hanford Works has been routinely measured for several years by Regional Survey, Radiological Sciences Department. For some time, it has been evident that the continuation of these measurements would be greatly aided if the exact relationship between the power level of the plant production process and the activity found in the river could be defined statistically. This would furnish an additional check on the accuracy of the reported sampling results, a test of "reasonableness" of these results, and a method whereby the actual effort involved in terms of the time and number of samples taken could be reduced considerably. In addition, predictions of the amounts of contamination from plant expansions could be estimated. For these reasons, a study has been made of the problem and an attempt made to define the relationship existing between three factors – power levels, river flow, and measured amount of beta particle emitters downstream. The period used for this analysis was from October 1949, to August 1951.

32054 (INIS-mf–11357, pp. 35-45) **Applications of environmental tritium and carbon-14 in water resources investigation in Taiyuan region China.** Cai Zuhuang (Academia Sinica, Beijing (China). Inst. of Geology); Shi Huixin. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

To evaluate the influence of exploiting karst groundwater by 0.5-1 cubic metre per second by Gujiao Coal Mine on the discharge rate of the major Lancun spring, Jinci spring and Xizhang waterworks in the Taiyuan region, Shanxi Province, and to seek new sources of water to make up for this influence, we carried out systematic hydrogeological studies in this region from 1983 to 1986, including measurement of 180 data of tritium, 49 data of carbon-13, 20 data of carbon-14, as well as more than 2,000 chemical data. Isotopic and chemical data were interpreted and used to distinguish the groundwater system, to determine the mixing ratios of various groundwaters, to trace the movement of groundwater both inside each subsystem and from one subsystem to another. Groundwater ages at 13 sites in the studied region were obtained after correction for mixing with young water, correction for dilution by dead carbon, and correction for variation of initial carbon-14 concentration. The velocity of groundwater flow was determined on the basis of groundwater ages. (author). 3 figs, 5 tabs.

32055 (INIS-mf–11357, pp. 7-22) **Environmental isotope study related to groundwater age, flow system and saline water origin in Quaternary aquifers of North China Plain.** Zhang Zhigan (Ministry of Geology and Mineral Resources, Guilin, Guangxi (China). Inst. of Karst Geology); Payne, B.R. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management*

seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

An isotopic hydrology section across the North China Plain has been studied to investigate problems of groundwater age, flow system and saline water origin in a semi-arid pre-mountain artesian basin. Two local and one regional flow system along the section have been recognized. Turnover time of water for alluvial fan, shallow and regional systems are estimated to be the order of 10/sup 2/ , 10/sup 3/, and 10/sup 4/years respectively. Specific flow rates for the three systems have been calculated. Only less than 5 percent of flow from alluvial fan is drained by the regional flow system and the rest, in natural conditions, discharges at surface in the front edge of an alluvial fan and forms a groundwater discharge belt at a good distance away from the mountain foot. Developed in the alluvial plain and coastal plain areas the shallow flow system embraces a series of small local systems. Groundwater in these systems appears to be the salt carrier during continental salinization. It washes salt out of the recharge area and deep-occurred strata by circulating and carries it up to the surface in lowland areas. Consequently, in parallel with salinization at surface a desalinization process occurs at depth, which provides an additional explanation for the existing thick deep fresh water zone in most arid and semi-arid regions, where continental salting process is in progress. (author). 6 refs, 8 figs, 4 tabs.

32056 (INIS-mf–11357, pp. 23-34) **Application of oxygen and hydrogen isotopes of waters in Tengchong hydrothermal systems of China.** Shen Minzi (Beijing Univ., Beijing (China). Dept. of Geology); Hou Fagao; Lin Ruifen; Ni Baoling. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

This paper summarizes the results obtained for hydrothermal systems in Tengchong by using deuterium, oxygen-18 and tritium as natural tracers. On the basis of deuterium and oxygen-18 analyses of 69 thermal springs and some other meteoric, surface and underground water samples it has been confirmed that all geothermal waters are originally meteoric, but the δD of hot spring waters is often lighter than that of local surface and underground waters. It seems that the recharging water is from higher elevations and far from the thermal areas. The differences in oxygen-18 and deuterium contents between thermal springs and deep thermal waters have been calculated for single-stage steam separation from 276 deg. C to 96 deg. C. The oxygen isotope shift of deep thermal water produced by water-rock reactions is of 1.57 per mille and part of the observed oxygen isotope shift of thermal springs seems to have occurred due to subsurface boiling. The tritium content (<1 to 16 TU) of hot springs in Hot Sea geothermal field suggests that there exists a mixing process somewhere by ascending hot water. By the diagrams of δD-Cl and δD-δ/sup 18/O three subsurface processes would have been distinguished, they are subsurface boiling, mixing-subsurface boiling and subsurface boiling-mixing. The springs formed by subsurface boiling have tritium content of less than 5 TU. The tritium content of 5-10 TU is for springs formed by mixing-subsurface boiling and 10-20 TU is for subsurface boiling-mixing. The tritium content of geothermal water in Hot Sea, geothermal field seems higher than that of the Geysers U.S.A. and Wairakei N.Z. It would show that the circulation time of the thermal water in Hot Sea geothermal system is not so long, the reservoir is quite good with percolation and the recharging water is sufficiently enough. (Abstract Truncated)

32057 (INIS-mf–11357, pp. 46-67) **Application of S. H. and O. stable isotopes to groundwater research in China.** Pan Shulan (Academia Sinica, Beijing (China). Inst. of Geology). International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The δD, δ/sup 18/O and δ/sup 34/S of a lot of samples from the groundwater in the Tai-Yuan area have been determined. The precipitation line (in the Tai-Yuan area) we obtained is δD=7.6δ/sup 18/O+10. A mixing line for west mountain karstic water and shallow water has been worked out. it is δD=5.6δ/sup 18/O-16. It has been concluded that the quantity supplied by shallow water to Jin Spring is about 34%. Two karstic water systems are divided into the West Mountain system and East Mountain system. The Lan Spring belongs to the east one. S-isotope data indicates that there is less supply to the Lan Spring from the West Mountain system. Some sample preparation methods and mass spectrometric measurements in our laboratory are described. (author). 4 refs, 9 figs, 8 tabs.

32058 (INIS-mf–11357, pp. 68-93) **Environmental isotope investigation of groundwaters in the region of Taiyuan, Shanxi Province of China.** Wei Keqin (Academia Sinica, Guangzhou (China). Inst. of Geochemistry); Lin Ruifen; Wang Zhixiang. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

A comprehensive environmental isotope investigation of several complex groundwater systems and the mixing of groundwater with surface water in the region of Taiyuan, Shanxi Province of China, is presented. Environmental isotopes, including stable isotopes, tritium and uranium series in water and its activity ratio /sup 234/U//sup 238/U are applied to divide karstic groundwaters into separate Xishan and Dongshan systems. The Xishan karstic water system shows a great scattering of isotope data. This results from the mixing of karstic groundwater and surface water from the Fenhe River. The Dongshan system is homogeneous and karstic water is tritium free and its age should be more than 50-100 a. The increase in uranium activity ratio, which is correlated with the length of the flow paths, shows the run-off direction of the Dongshan karstic water system towards the major natural outlet, the Lancun Spring. The altitudes of recharge of Xishan and Dongshan karstic waters are evaluated as 1400 m and 1300 m, respectively. The ages of fissure groundwaters in metamorphic rocks are determined in terms of their tritium content. Some practical considerations upon groundwater management are also drawn from isotope results. (author). 9 refs, 10 figs, 9 tabs.

32059 (INIS-mf–11357, pp. 94-103) **Application of isotope method in ground water resources investigation.** Liu Guangyao (Ministry of Metallurgical Industry, Baoding, Hebei (China). Inst. of Geotechnics, Hydrogeology and Photogrammetry). International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

It is well known that acquiring aquifer parameters by pumping test has been an expensive and time-consuming job which can hardly meet the needs of advanced estimation of ground water resources. However, the isotope method of measuring the parameters is proved to be a fast and cheap one. Through the field tests of four projects, we have determined the filtration velocity at 386 measuring points in 35 boreholes by the single-hole dilution method. The results have shown that using this method properly may solve some hydrogeological problems. (author). 2 refs, 2 figs, 3 tabs.

32060 (INIS-mf–11357, pp. 104-140) **Environmental isotope-aided studies on river water and groundwater interaction in the region of Seoul and Taegu.** Jong Sung Ahn (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Environmental isotope-aided studies on river water and groundwater interaction in the Han River Basin in areas especially occupied by crystalline rocks and limestone have been undertaken. The result indicates that the groundwater in the Seoul area is recharged by the Han River whereas in non-urban areas it is replenished by the infiltration of precipitation, the crystalline rock aquifers are recharged by downward percolation of shallow groundwater stored in overlying alluvium. Older groundwater having a very low concentration of tritium, ranging from 0 to 2 TU, was observed at the lower Han River basin near Bupyeong. It may indicate that the water sampled was recharged at a much earlier time than the other groundwater sampled, maybe, as early as the pre-thermonuclear period. The same interaction study conducted in the Karst area has shown that there is clearly no systematic differences of tritium level between surface water and groundwater and that the residence time of groundwater in limestone is very short, probably not longer than a few months. The areas recharged by the water from the overlying alluvium into the sedimentary rock aquifer were restricted only along the Kumho River channel and its tributaries in a clastic sedimentary rock area. Bedrock groundwater whose tritium level and stable isotope composition were less than 14 TU and -6.8 respectively was observed in the central part of Taegu city. (author). 15 refs, 21 figs, 8 tabs.

32061 (INIS-mf–11357, pp. 141-170) **Environmental isotope-aided studies on water resources in the region of Cheju.** Jong Sung Ahn (Korea Advanced Energy Research Inst., Daeduk (Republic of Korea)). International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The type of groundwater yielded from existing deep wells situated within 2 km from the coastal line in U-do and Songsan area is classified as category 7, that is primarily salinity dominated by alkalies and strong acid such as saline water. The chlorine contents of the groundwater ranges from about 200 ppm to 600 ppm. Tritium, deuterium and oxygen-18 contents of seawater are 5.74±0.49 TU, -4.6±1.20/00, -0.8±0.02 0/00 in maximum and 8.67±0.45 TU, -24±0.18 0/00, -3.61±0.12 0/00 in case of rainwater and 15.11±0.61 TU, -43.4±1.12 0/00, -7.2±0.5 0/00 in case of pure and non-affected groundwater by salt water encroachment. In general the groundwater bodies being highly affected by salt water intrusion are characterized by that content of tritium is similar to or identical with the pure-unaffected groundwater and contents of stable isotopes are higher. (author). 18 refs, 13 figs, 12 tabs.

32062 (INIS-mf–11357, pp. 171-176) **Use of isotope techniques to investigate saltwater intruded aquifers in the Philippines.** Peralta, G.L. (National Environmental Protection Council, Diliman, Quezon City (Philippines)). International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Studies in Metro Manila area have identified inland bodies of saline water which have been called "connate water". It has been refered to in literature as saline water occurring inland at a range of depths, in close association with freshwater. The relationships between these various bodies of saline water are not clear and for groundwater development planning it would be useful to determine whether the inland cases are a series of small isolated residual bodies from the last marine transgression or parts of a large continuous saline body. Furthermore the origin and mechanism of natural groundwater recharges are often not clear from the chemical and hydrogeological data as in the island of Cebu. In these circumstances it was recommended that useful planning data be obtained from a study of the concentrations of natural isotopes in the groundwater, particularly in the areas of Manila, Cebu and Bulacan-Pampanga.

32063 (INIS-mf–11357, pp. 177-195) **Application of stable isotopes to hydrogeology in coal mine.** Duan Qi (Ministry of Coal Industry (China). Inst. of Geology and Exploration); Duan Yucheng. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Stable isotopes including Oxygen-18 and Deuterium have been applied to investigation of hydrogeology in main coal mines. By determination of stable isotopic composition of hydrogen and oxygen together with water analysis, the following studies have been developed: Identification of the hydrogeochemical characteristics of the groundwater from varied aquifers; Analysis of the hydraulic relationship between varied aquifers; Interpretation of the probable recharge source of mine water. The research results mentioned above reveal that: 1. The groundwater from main aquifers at coal mines in north China is of meteoric origin, which is recharged from hilly area surrounding the coal mine. Its isotopic composition differs slightly from that of the local precipitation. 2. There is a mutual hydraulic relationship between the Ordovician and Quarternary aquifers, so the difference of isotopic composition is very small. 3. By way of the variation of isotopic composition of groundwater from coal-bearing strata, we can infer the hydraulic relationship extent between overlaid alluvial layer and underlaid Ordovician limestone. (author). 9 refs, 6 figs, 8 tabs.

32064 (INIS-mf–11357, pp. 196-207) **Review of data of oxygen and hydrogen isotope composition in thermal waters in China.** Fan Zhicheng (Academia Sinica, Beijing (China). Inst. of Geology); Wang Jiyang. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Based on the data of δD and δ/sup 18/O content from more than 600 water samples, this paper reviews the stable isotope composition of thermal waters in China. Data to be used in this paper were mostly collected from published literatures with a few by authors. 9 figs, 2 tabs.

32065 (INIS-mf–11357, pp. 208-215) **Origin of the yellow brine and the black brine in Sichuan Basin.** Wang Dongsheng (Ministry of Geology and Mineral Resources, Zhengding, Hebei (China). Inst. of Hydrogeology and Engineering Geology). International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional*

workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987. Order Number DE89610309/JAW. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The spring water, geothermal water and Cretaceous brine in the outer zone of the Sichuan Basin has the Craig relationship, and they are cycling waters. The brine in the inner zone is mainly metasedimentary water. A basic feature of them is poor in /sup 2/H, but rich in /sup 18/O. The δD-values of the yellow brine in Jurassic and Upper Triassic aquifer of continental facies varies from -62.25 to -22.4, and the δ/sup 18/O-values are -6.72 - +6.02. The δD-values of the black brine in marine aquifer (T/sub 2/,T/sub 1/,P,C,O and so on) varies from -49 to -25.1, and the /sup 18/O values are +3.89 - +6.14. The δD of yellow brine is similar to that of meteoric water, and the δD of the black brine is around that of crystallization water expelled from gypsum by anhydritization. Increases of salinity in Jurassic yellow brine result primarily from the evapotranspiration process. The salinity in Upper Triassic yellow brine in Aa sub-area originated from underlying rock salt which was leached by paleometeoric water. Triassic black brine derived from the mixing of the crystallization water leached from rock salt with the residual sea water after salt crystallization. In Zhigong, the composition of yellow brine has mainly been changed by the mixing of the yellow brine with the black brine. (author). 2 refs, 2 figs, 2 tabs.

32066 (INIS-mf–11357, pp. 231-254) **Laboratory studies into the use of the scandium-46-EDTA complex as a tracer for groundwater flow.** Cheng, H. (Nanjing Hydraulic Research Inst., Nanjing (China)); Nixon, S.C. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Gamma ray emitting metal radionuclides, when complexed with an appropriate complexing agent, provide a wide choice of water tracers particularly for groundwater studies where a radionuclide of appropriate half-life suited to the particular study can be selected. Scandium-46 has easily detectable gamma emission and a suitable half-life (84 days) for medium term studies. It has been widely and successfully used as a tracer in studies of sediment movement but has not yet been introduced as a groundwater tracer. In our experiments the chemical aspects of the preparation of Sc-46-EDTA were studied in some detail and its behaviour in various mineralogical environments was evaluated with reference to the standard tracer, tritiated water. The experimental results have shown that the scandium cation can be easily complexed with EDTA to form soluble SC-EDTA. The complex is very stable in a wide range of pH; the adsorptive properties of Sc-EDTA in the batch studies and the retardation and recovery in the column tests in comparison with tritiated water are quite satisfactory. In general Sc-46-EDTA is a promising tracer for groundwater studies. In the report the appropriate conditions, procedures and some rational and efficient methods for testing the purity of Sc-46-EDTA in the preparation of the tracer solution of Sc-46-EDTA are described. In addition, it has been found that the formation of the metal hydroxide colloids is the major reason for the great loss in groundwater aquifers of most trivalent metal nuclide tracers in the cationic form including scandium-46. (author). 29 refs, 11 figs, 12 tabs.

32067 (INIS-mf–11357, pp. 216-230) **Study of the groundwater origin in Hebei Plain with isotopic method.** Liu Cunfu (China Univ. of Geosciences, Wuhan (China)); Wang Henchun; Wang Peiyi. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

A result from analysing data of isotopic compositions of groundwater and precipitation sampled in Hebei Plain indicates that: (1) the shallow groundwater of Hebei Plain is recharged from recent precipitation; (2) the salt waters distributed at middle depth of the center part of this plain is formed by continent salification and distributed at coastal area of the east part is formed by sea water invasion in late Quaternary period; (3) the deep groundwater in the research area was originated from precipitation in Quaternary ice age. The mean temperatures of paleoclimate in Q/sub 1/-Q/sub 4/ periods are counted based on the data of deuterium and oxygen-18 in the groundwaters and the history of coastline migration is also presented in the paper. (author). 3 refs, 11 figs, 5 tabs.

32068 (INIS-mf–11357, pp. 277-282) **Formation condition of the Lushan hot spring and its genesis.** Li Xueli (East China Geological Inst., Fuzhou, Jiangxi (China)); Shi Weijun; Yang Zhongyao; Hao Shiyin. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

THERMAL SPRINGS/age estimation; THERMAL SPRINGS/isotope ratio; CHINA; DEUTERIUM; OXYGEN 18; TRITIUM

32069 (INIS-mf–11357, pp. 283-301) **Radioisotope distribution characteristics of the groundwater system in volcanic-type U deposits and isotope-dating estimation of the system.** Zhou Bingguan (Institute No. 270, Nanchang County, Jiangxi Province (China)). International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

On the basis of groundwater sample measurements collected from the uranogenic belt of Mesozoic volcanic rocks in East China, the distribution characteristics of radioisotopes, including the total U content (CΣu), the activity of nuclides (Aui) or their activity ratio (ARu) and the relationship among the three ((Aui,ARu)=f(CΣu)), have been studied. Also, it is performed for radioactive water halos in the area to be divided into four various mineralization tendencies: (1) the convergent tendency of negative correlation, which has the genetic relationship with the primary U accumulation in volcanic rocks; (2) the scattered tendency of positive correlation, which is intimately related to epigenetic U mineralization in the supergene zone of volcanic rocks or in the sandstones; (3) the both positive and negative multiple-correlative tendency, which indicates that the primary volcanic-type U deposit has been leached and destroyed, and the secondary U enrichment has occurred within the supergene zone; (4) non-correlative tendency, which mainly results from increasing dispersion U. For the above recognitions, an evolution model for radioactive water halos related to this type of U deposit has been derived, and an attempt to estimate the radioisotopic age of the groundwater system also has been made. (author). 14 refs, 9 figs, 2 tabs.

32070 (INIS-mf–11357, pp. 302-313) **Applied research on developing groundwater sources with Po-210 detecting instrument.** Cheng Caie (Sichuan Inst. of Applied Nuclear Technology (China)); Wu Zhijun; Shi Lei. International Atomic Energy Agency, Vienna (Austria). 1988. (CONF-8706389–: Regional workshop on isotope hydrology for Asia and the Pacific, Beijing, China, 15-26 Jun 1987). In *Isotope applications in hydrology in Asia and the Pacific. Proceedings of a regional executive management seminar on isotope techniques in water resources development and management and a regional workshop on isotope hydrology for Asia and the Pacific held in Beijing, 15-26 June, 1987.* Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

According to the needs of national economic construction, our institute has conducted an applied research for seeking groundwater resources with the Po-210 counter for various enterprises, institutions in the countryside, towns, plants, mines and schools etc. since 1980. The quantity of the Po-210 can be measured in the overburden and leached layers for giving a clue to water-bearing structure under overburden. The Po-210 was extracted from soil samples by process of electrochemical displacement, subsequently, the source of no-carrier was prepared by using copper as substrate. The α-source was prepared by using non-oscillating temperature controlled in the analytical chart. Experimental and technological conditions are as follows: constant temperature to about 90 deg. C, the time displaced is 3-4 hours, concentration and volume of chloric acid are 2N and 15-45 ml, respectively. The α-radioactive source which has no-carrier was detected by using FD-3005 type low-background α-counter. The recovery of Po-210 for this method averages 85.8%, and the detection sensitivity for Po-210 is about 2.02center dot10/ sup -16/g/g (equivalent to 0.45 ppm eU). The method of surveying Po-210 has been applied to investigate water in the area of thinker overburden. The detection for the method has high sensitivity and halo-region remains stable. The topography and climate have a little influence on the detection results and thus the method has some advantages compared with γ-method prospecting for water in this respect. Simultaneously this method is a short and easy operation with less interference factors which is superior to the α-track determination method in this respect. In addition, it is also characteristic of less investment and rapid efficiency as well as easy spread and use. This method has been applied in Taian, Shandong; in Nanjing, Jiangsu; Chongqing, Zigong and Yibin, Sichuan, etc.

32071 (NSS/R–132) **Guide to PICKER - a data selection program for the geochemical code PHREEQE.** Tweed, C.J. United Kingdom Nirex, Ltd., Harwell (UK). Oct 1988. 18p. (AERE-R–12515). Order Number DE89616250/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Program PICKER is a data-selection program for the geochemical code PHREEQE. It enables the PHREEQE code to be used in conjunction with a fully documented master database, such as the Nirex HATCHES database without the need to amend the program to store unnecessarily large amounts of data. The program PICKER performs data selection prior to each run, or set of runs, using the program PHREEQE. The user supplies a list of the elements to be included in a particular series of calculations, and the program scans the large database and selects all the possible species and minerals which the elements may form. These data are then converted into the format required by the original, verified PHREEQE code. No other selection criteria such as data quality or kinetic constraints are introduced. Thus use of the PICKER code for data selection does not bias the calculation in any way. The method combines the versatility of a large thermodynamic database with the efficiency of the original, well-verified PHREEQE code.

32072 (OEVS-Mitteilung–1988, pp. 216-225) **Radiological analysis of the upper Danube river system -a 20 years research programme.** Huebel, K. (Bayerische Landesanstalt fuer Wasserforschung, Muenchen (Germany, F.R.)); Herrmann, H.; Laschka, D.; Litzke, J.; Luensmann, W. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

First, the amounts and compositions of radioactive effluents from the Gundremmingen power station are given for 1967 - 1984. As the main transmission path to the population is through the fish, concentration factors are given for the isotopes cobalt 58, cobalt 60, cesium 134 and cesium 137. Finally, tritium concentration in surface waters in the watershed of Danube and Main are given. 2 figs., 3 tabs. (qui).

32073 (OEVS-Mitteilung–1988, pp. 226-230) **Radioecological investigations in the Austrian part of the Danube river.** Tschurlovits, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna (Austria)); Buchtela, K.; Unfried, E. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Systematic assessments of the activity concentration of some radionuclides in the water of the Danube river were carried out in a consistent form from 1977 to 1985 on a monthly sampling basis. Selective measurements were carried out and the lowest detectable activity concentration was chosen to be well below the required level which was given on the one hand by the already existing activity concentration and on the other hand by unsignificant levels of doses resulting from the use of the Danube in different pathways. The results of these investigations are reported and some interesting parameters are derived from the results. The origin of the detected artificial radionuclide concentrations was clearly identified as to be from nuclear weapons fallout. This was proved by clear seasonal variations of some radionuclides. 7 refs., 3 figs., 1 tab.

5204 Thermal Effluents Monitoring and Transport

Refer also to citation(s) 31864

32074 (SNV–3447) **Recipient control at Forsmark power station 1987.** Krogh, E. National Swedish Environmental Protection Board, Solna (Sweden). Feb 1988. 34p. (In Swedish). Order Number DE89616624/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report presents investigations started to show early effects of cooling water discharges, i.e. mainly studies in the Biotest lake. A new revised test program was established in 1987. Net fishing and ground fauna investigations in the Biotest lake are done every two months and are currently reported. From this year on the yearly reports will comprise the main part of the, in terms of volume, greater control items. (O.S.).

5205 Site Resource and Use Studies

Refer also to citation(s) 30679, 30680, 30681, 30682, 30683, 30684, 30685, 30686, 30687, 30688, 30689, 30690, 30691, 30692, 30693, 30694, 30695, 30696, 30697, 30698, 32038

32075 (PB–89-162317/XAB) **Fiscal Year 1987 program report: Alaska Water Research Center.** Brown, E. Alaska Univ., Fairbanks (USA). Water Research Center. Oct 1988. 43p. Available from NTIS, PC A03/MF A01.

See also PB–88-164488.

Seven small projects were funded by the U.S. Geological Survey (USGS) Federal Cooperative Water Resource Program in Fiscal Year 1987. One project studied the paleohydrology of the Tanana River to better understand future floods in interior Alaska. Another project is examining how benzene interacts with ground water when found in northern regions. A third project is reexamining the details of the nitrogen cycle and how it affects a subarctic lake. Another project collected information on arsenic contamination of ground water and has produced a risk-assessment publication to benefit the public. Stable nitrogen isotopes are being used in another project to determine the sources of nitrate in ground waters of interior Alaska. Another project has assessed stream flow sediment transport for engineering projects and finally, one project suggests that atomic absorption spectrophotometers can be modified to measure 15N/14N ratios in a variety of substances pulsed with 15N.

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

Refer also to citation(s) 30598

5301 Social and Economic Studies

Refer also to citation(s) 30676

5302 Assessment of Energy Technologies

Refer also to citation(s) 30806

55 BIOMEDICAL SCIENCES, BASIC STUDIES

Refer also to citation(s) 30986, 30990

32076 (PB–89-160691/XAB) **Endangered Species Listing Handbook: handbook to preparing and processing actions to list, delist, or reclassify endangered or threatened species (third edition).** Sheppard, J.M. Fish and Wildlife Service, Washington, DC (USA). Div. of Endangered Species and Habitat Conservation. Jan 1989. 167p. Available from NTIS, PC A08/MF A01.

Also available from Supt. of Docs.

This Handbook is used to prepare or complete actions to list, delist, or reclassify endangered or threatened species. The handbook provides technical guidelines for the preparation of any notice, proposed rule, or final rule relating to endangered species listings, delistings, reclassifications, critical habitat designation, special rules, petition findings, and experimental populations. The handbook will assist managers, biologists, and clerical staffs in the preparation of listing documents.

5502 Biochemistry

Refer also to citation(s) 30704, 30716, 31384, 31459, 32203

32077 (CONF-8704370–) **Eukaryotic transposable elements as mutagenic agents.** Banbury Report Series No. 30. Lambert, M.E.; McDonald, J.F.; Weinstein, I.B. (eds.). Cold Spring Harbor Lab. of Quantitative Biology, ME (USA). c 1988. 345p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER60551. From Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, New York, USA; 21 Apr 1987. Available from Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724.

Recently, there have been major advances in our understanding of the molecular mechanisms underlying retrotransposition and a growing appreciation of the importance of repetitive DNA sequences and transposable elements in shaping eukaryotic genome structure. This work has focused attention both on the potential of these genetic elements to act as mutagenic agents and on the regulation of such mutagenic processes at the cellular level. Many different experimental approaches in yeast, Drosophila, and mammalian systems, are now in use to characterize the range of mutational events mediated by such genetic elements and to study the interplay of both host genes and various forms of environmental and physiological stress, including DNA damage, on these processes. Despite this progress, there have been few efforts to bring together interested investigators for the explicit purpose of reviewing and assessing this field. To create further interest in this field, a conference was recently held within the setting of the Banbury Center, devoted exclusively to an in-depth evaluation of current work in this area. The conference brought together experts in the areas of eukaryotic retroviruses and transposable elements, cancer biology, DNA damage and repair, and human risk assessment. Particular emphasis was placed not only on description of the types of mutations caused by rearrangement of these elements, but also on the involvement of DNA damage, "genomic stress" and host genes in the modulation of viral latency, alteration in viral gene expression, and mediation of transpositional processes. This current report continues a Banbury Center tradition of publishing reviews in emerging areas in molecular biology central to human risk assessment and cancer biology. Individual papers were processed separately for the database.

32078 Evolution of catalytic function. Koshland, D.E. Jr. (Univ. of California, Berkeley (USA)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Evolution of catalytic function was, until recently, the exclusive domain of protein chemists. Unfortunately, a group of nucleic acid chemists developed suggestions of an RNA world that cannot be ignored in the evolution of catalytic function. Since that is even more speculative than protein evolution, the authors first examines the evolution of catalytic function in proteins and then attempts to extend those principles to a few aspects of RNA.

32079 Evolution of the genetic apparatus: a review. Orgel, L.E. (Salk Institute for Biological Studies, San Diego, CA (USA)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

A review is presented of the literature on the earlier period of evolution-that preceding the fixation of the nucleic acid/protein system in its contemporary form. A period of speculative fever in this field arose in the late 1960s and early 1970s. Most of the ideas discussed here, including the hypothesis of a protein-free, catalytic-RNA-dependent organism, were put forward at that time. Often, the same idea occurred independently to several researchers, whereas a single author may have waxed and waned in his or her enthusiasm for a particular strand in the argument. The situation is not dissimilar today: The new wave of speculation is inspired by the remarkable experimental discoveries of intron and catalytic RNA's.

32080 Which organic compounds could have occurred on the prebiotic earth?. Miller, S.L. (Univ. of California, San Diego, La Jolla (USA)). pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In the past three decades, a wide variety of experiments have been designed to simulate conditions on the primitive earth and to demonstrate how organic compounds that made up the first living organisms were synthesized. This paper reviews this work and indicates the status of such syntheses.

32081 Prebiotic synthesis: problems and challenges. Ferris, J.P. (Rensselaer Polytechnic Institute, Troy, NY (USA)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The spontaneous synthesis of amino acids in electric discharge experiments, the direct formation of purines form HCN, and the synthesis of oligonucleotides by the template-directed condensation of activated nucleotides are selected experiments which suggest that the field of chemical evolution is making rapid progress in its search for an understanding of the chemical processes leading to the origins of life. But it is quite apparent to most of us working in this field that many important questions must be answered before we can claim that a complete picture of even the early stages of chemical evolution has emerged. Some gaps in our understanding in our understanding of prebiotic reaction pathways are reviewed in this paper, and an alternative approach to the experimental study of these and other problems in chemical evolution is outlined.

32082 In search of RNA ancestors. Schwartz, A.W. (Univ. of Nijmegen (Netherlands)); Visscher, J.; van der Woerd, R.; Bakker, C.G. pp. 5 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The recent discoveries of catalytically active RNA species have reinforced the view that a key step in the emergence of life on earth may have been the development of self-replicating RNA molecules. Although much progress has been made in recent years toward the

development of an experimental model of RNA replication, there remain many problems that have yet to be overcome. Recent results suggest the possibility that nucleic acid analogs that are capable of maintaining Watson-Crick base-pairing but have novel backbone anatomy could have performed just this function. A number of examples are known template-directed oligomerizations that are catalyzed by conventional polynucleotides but produce unusual backbones. The oligomerization of 3'-amino-3'-deoxynucleoside-5'-phosphoimidazolides produces 3'-5'-linked phosphoramidates. Pyrophosphate-linked products have been synthesized by the oligomerization of deoxynucleoside-3',5'-diphosphates. As a first step toward testing the hypothesis that structurally simpler analogs might have served as the basis for a primitive information-transfer system, the authors have developed a synthetic strategy for the preparation of pyrophosphate-linked deoxynucleoside oligomers of defined sequence. Here, they report some initial results of a study on the oligomerization of one such dimer.

32083 Nonenzymatic template-directed synthesis of information macromolecules. Joyce, G.F. (Salk Institute for Biological Studies, San Diego, CA (USA)). pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The author reviews the progress that has been made in the area of nonenzymatic template-directed RNA synthesis. This work has led to the development of chemical systems for macromolecular information transfer. It is possible to transfer sequence information from RNA to RNA and from DNA to RNA, in analogy to the behavior of an RNA-dependent or DNA-dependent RNA polymerase. These reactions are not general with respect to template sequence, and thus do not easily lend themselves to the construction of a self-replicating system. Self-replication has been demonstrated in a very limited sense using chemically modified RNA substrates and a well-chosen self-complementary template. However, until systems of this kind can be expanded to include a variety of template sequences, there is not way to conduct an evolutionary search for alternative sequences that are associated with novel behavioral phenotypes.

32084 Natural selection, protein engineering, and the last riboorganism: rational model building in biochemistry. Benner, S.A. (Swiss Federal Institute of Technology, Zurich (Switzerland)); Allemann, R.K.; Ellington, A.D.; Ge, L.; Glasfeld, A.; Leanz, G.F.; Krauch, T.; MacPherson, L.J.; Moroney, S.; Piccirilli, J.A. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

A detailed study of the chemical behavior of modern catalysts (here, exemplified by dehydrogenases dependent on NAD^+) allows the authors to construct models that distinguish between selected and drifting behaviors in biological macromolecules. These models enable them to manipulate rationally the properties of enzymes, here to design an acetaldehyde reductase dependent on NAD^+ that is faster than any given them by nature. When applied to the origin of protein catalysis, models that explain the structures of ribocofactors (e.g., NAD^+) must postulate a metabolically complex breakthrough organism. This means that: (1) The view from the present day back to the truly primeval organism is obscured; it is futile to try to deduce the detailed structure of the first life by examining the behaviors of modern organisms. (2) Riboorganisms dominated life on earth for a long time before translation evolved; indeed, fossils of riboorganisms might already be known. (3) Using organic synthesis, they have expanded the number of bases available for making RNA and making accessible RNA molecules that are likely to be intrinsically better catalysts.

32085 Economics of enzyme catalysis. Jencks, W.P. (Brandeis Univ., Waltham, MA (USA)). pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

One of the revolutions of this century is the development of our knowledge of catalysis by enzymes to the point where it can be examined in ordinary chemical terms. There is optimism that chemistry can explain enzymatic catalysis without requiring vitalistic or mystical hypotheses. Nevertheless, it is clear that we are far from being able to provide such a chemical explanation today and that very little is known quantitatively about the enormous rate accelerations brought about by enzymes for reactions of their specific substrates. With few exceptions, chemical catalysts do not begin to approach the catalytic efficiency or specificity of enzymes. Three topics that are important for enzyme catalysis are reviewed. First, the importance of strain and destabilization of a bound substrate is evaluated. Second, the advantages of induced intramolecularity in enzyme catalysis is discussed. Third, the conformational changes that enzymes undergo and the reasons for these changes are explored.

32086 Artificial enzymes. Breslow, R. (Columbia Univ., New York, NY (USA)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The properties and structures of enzymes help to inspire the construction of novel chemical catalysts. The aim is to produce new catalysis systems that might have some of the same high selectivities and high rates characteristic of enzyme processes but that might have special advantages over natural enzymes. Such catalysts need not be proteins, so they could have improved stabilities. In addition, such catalysts could be prepared to perform reactions for which no natural enzymes occur. Many of the most important chemical processes of interest to us in chemical manufacturing, for instance, are not processes that are also performed enzymatically in nature. However, appropriately developed artificial enzymes could in principle perform these useful chemical reactions with an enzymatic style and with the resultant advantages of selectivity and rate characteristic of this style. The authors have been active in this field for approximately 30 years and have coined the term Biomimetic Chemistry to describe it. They have also reported the first synthesis of a catalyst described as an artificial enzyme. Since this work has involved a very large effort and has been reviewed elsewhere, the present paper will be somewhat selective. The author describes here some of the more interesting systems that they have prepared and also indicate the most recent developments of these types of systems.

32087 Phosphorus-containing peptide analogs as peptidase inhibitors. Bartlett, P.A. (Univ. of California, Berkeley (USA)); Marlowe, C.K.; Giannousis, P.P.; Hanson, J.E. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

A general and highly effective approach for the design of an enzyme inhibitor is to devise a molecule that resembles the putative transition state of a high-energy intermediate along the reaction pathway. Such a strategy is based on the recognition that the lower activation energy of the enzyme-catalyzed transformation reflects a corresponding increase in the binding energy between the enzyme and the substrate as their complex proceeds from the ground state to the transition state conformation. If a transition state analog can take advantage of even part of this additional binding energy, it will be a highly effective inhibitor. The major change in the structures of the ground and transition states for hydrolysis of a peptidase substrate is the progression in geometry of the carbonyl carbon from trigonal to tetrahedral. Incorporation of a functional group that can adopt the tetrahedral geometry has therefore been crucial to the design of transition state analog inhibitors for these enzymes. For the zinc and aspartic peptidases, which do not involve a covalently bound intermediate, a particularly attractive design motif is to incorporate a phosphorus atom in place of the carbonyl carbon of the scissile linkage. The high valency of phosphorus allows a number of

heteroatom substituents to be incorporated at this position while retaining a stable tetrahedra geometry. In addition to the authors work reviewed here, phosphonic and phosphinic amino acid analogs have been incorporated into substrate sequences appropriate for a number of other zinc peptidases and have been shown to give rise to potent inhibitors.

32088 Catalytic antibodies. Tramontano, A. (Research Institute of Scripps Clinic, La Jolla, CA (USA)); Janda, K.; Napper, A.D.; Benkovic, S.J.; Lerner, R.A. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

This work demonstrates that the binding energy of antibodies can be harnessed for chemical synthesis. The authors foresee that other chemical reactions will be addressed and that catalytic antibodies should apply to any chemical reaction for which a credible mechanism can be visualized and an appropriate transition state analog synthesized. The real question is how best to proceed at this incipient stage of the research given the vast possibilities. Their approach is to address some important chemical and biochemical problems using catalytic antibodies. Thus, they are currently turning their attention to antibodies capable of hydrolyzing amide bonds as well as those that should catalyze important synthetic reactions. A complementary part of current experiments is to learn how to control the kinds of amino acid side chains that an antibody will employ in response to a certain antigenic challenge. For example, an antibody may stabilize point charges on an antigen by using side chains in the binding pocket of opposite charge. One can thus think about designing antigens with geometrically spaced point charges so that a geometry of opposite charges is reflected in the antibody-binding pocket. Such a constellation of negative charges might be expected to be able to coordinate an oxidized metal ion which would be important for various catalytic applications.

32089 Antibody catalysis by transition state stabilization. Pollack, S.J. (Univ. of California, Berkeley (USA)); Schultz, P.G. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The development of strategies for introducing catalytic activity into the combining sites of antibodies may enable the authors to generate rationally enzyme-like catalysts with tailored specificities and catalytic properties. They are currently exploring three such strategies: (1) generation of antibodies that selectively stabilize the rate-limiting transition state on a reaction pathway, (2) generation of antibodies that bind and orient substrates in a reactive conformation for intra- or intermolecular reactions, and (3) selective chemical modification of antibody combining sites with synthetic catalytic groups. They report here the properties of a second phosphorylcholine-specific antibody and discuss these properties in relation to the mechanism of the antibody-catalyzed reaction.

32090 Engineering of antibodies with a known three-dimensional structure. Plueckthun, A. (Max-Planck-Institut fuer Biochemie (Germany, F.R.)); Glockshuber, R.; Pfitzinger, I.; Skerra, A.; Stadlmueller, J. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

It has been demonstrated that an antibody with a known three-dimensional structure may provide a promising experimental model for the systematic study of binding and rate acceleration. The authors therefore decided to work out an experimental system in which such an antibody may be altered by design and in which active fragments of the antibody and its mutants can be obtained in large amounts for experimental investigations. They describe here the gene synthesis and bacterial expression of the F_V and F_{ab} fragments of the antibody protein. The genes corresponding to the variable domains V_H and V_L were obtained synthetically using the known protein sequence. The gene for the light-chain constant domain C_L was derived from a genomic clone, where the gene for the first constant domain of the heavy-chain C_{H1} was obtained from a cDNA clone of a mouse IgAl.

32091 Conformational changes and dynamics of tRNAs: evidence from hydrolysis patterns. Dock-Bregeon, A.C. (Institut de Biologie Moleculaire et Cellulaire, Strasbourg (France)); Moras, D. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Splitting of the ribose-phosphate chain of RNA has been reported in different works dealing with mRNA. Crystals provide a homogeneous sample of molecules, free from ribonucleases and under controlled conditions of ionic strength, pH, and temperature. Observation of the cleavage of the backbone of crystallized tRNAs has already been reported. Degradation patterns in $tRNA^{Asp}$ crystals were shown to be dependent on the conformation of the molecule. Analysis of cleavage sites in crystals of tRNAs of known three-dimensional structure may provide some interesting insights into the cleavage mechanism or at least some information about the structural constraints of the reaction. Moreover, since the discovery of self-splicing, a new concept of catalysis where RNA acts as substrate and catalyst is emerging. Since crystal packing could generate a matrix for the hydrolysis reaction in a way that could be related to the splicing process, it was also tempting to analyze this aspect of the hydrolysis data in light of the available information provided by tRNA crystals concerning conformations as well as interactions of these molecules.

32092 Improved parameters for prediction of RNA structure. Turner, D.H. (Univ. of Rochester, NY (USA)); Sugimoto, N.; Jaeger, J.A.; Longfellow, C.E.; Freier, S.M.; Kierzek, R. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Thermodynamic studies of oligoribonucleotides are providing parameters and insights for the fundamental interactions that determine RNA structure. These results can be used to predict the secondary structure of RNA from its sequence. Comparisons of predicted structures with those deduced from phylogenic data indicate a modest success rate that is improving as more parameters are determined experimentally. Two major fundamental interactions in RNA are stacking and hydrogen bonding. Both contribute similar increments to free-energy changes for associations of oligoribonucleotides. Thus, parameters for stacking and hydrogen bonding will likely be important for predicting the three-dimensional structures of RNAs and for interpreting RNA-RNA associations. Both applications should be important for providing a full understanding of catalysis by RNA.

32093 Structures involved in Tetrahymena rRNA self-splicing and RNA enzyme activity. Been, M.D. (Univ. of Colorado, Boulder (USA)); Barfod, E.T.; Burke, J.M.; Price, J.V.; Tanner, N.K.; Zaug, A.J.; Cech, T.R. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Following the discovery of self-splicing group I RNAs, the authors have been working to establish structure-function relationships for this class of RNA-splicing reactions. The immediate goal has been to understand the biochemical mechanism of an important step in gene expression. The long-term goal is to understand mechanisms of RNA catalysis: Does RNA catalysis simply recapitulate catalytic strategies already understood for protein enzymes, or will novel mechanisms of catalysis be uncovered? The chemistry of self-splicing RNA and RNA enzymes has been reviewed recently. In this paper, they review our current understanding of the RNA structures that are responsible for self-splicing of the Tetrahymena IVS RNA and ideas about how these structures contribute to catalysis.

32094 Implications of intermolecularly catalyzed reactions by the Tetrahymena ribozyme. Kay, P.S. (Salk Institute for Biological Studies, San Diego, CA (USA)); Inoue, T. pp. 7 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The authors have discovered that a newly prepared large fragment of the IVS RNA of Tetrahymena, termed L - 21 ScaI IVS, can mediate a simple transesterification reaction between the substrate GpN (N = A, C, G, or U) and the nucleophile CpU. In this paper, they further discuss the nature of L - 21 ScaI ICV RNA. L - 19 IVS RNA, lacking 19 nucleotides from the excised full-length linear IVS RNA or Tetrahymena pre-rRNA, acts as an RNA catalyst and has been shown to behave as a nucleotidyl transferase, a phosphodiesterase, a phosphotransferase, and an acid phosphatase. Thus, a comparison of the activity of L - 21 ScaI IVS RNA to that of L - 19 IVS RNA was performed under a variety of conditions.

32095 Internal guide sequence and reaction specificity of group I self-splicing introns. Davies, R.W. (UMIST, Manchester (England)); Waring, R.B.; Towner, P. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The RNA structure of group I introns is the key to their function as catalysts and to the specificity of the reactions catalyzed. All the evidence available support the authors proposed model, the Tet intron version. The RNA structure can be divided into two sections: a core region, including P-Q, R-S, and E-E', that has been shown experimentally to contain all of the structures necessary for catalysis, and two base-paired regions in which contiguous sequences of the intron pairs with exon sequences, proposed to be important for alignment of the 5' and 3' splice junctions.

32096 Genetic dissection of an RNA enzyme. Doudna, J.A. (Massachusetts General Hospital, Boston (USA)); Gerber, A.S.; Cherry, J.M.; Szostak, J.W. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this paper, the authors describe deletions and substitution mutations in the catalytic and substrate domains of the self-splicing intron. These mutations further define the essential regions of the enzyme and its substrate.

32097 Reactions mediated by yeast mitochondrial group I and II introns. Tabak, H.F. (Univ. of Amsterdam (Netherlands)); Van der Horst, G.; Winter, A.J.; Smit, J.; Van der Veen, R.; Kwakman, J.H.J.M.; Grivell, L.A.; Arnberg, A.C. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The simple techniques to synthesize experimental precursor RNAs with group I or group II introns in vitro allow one to investigate the reactions in detail and to study the effects of deletions, insertions, and nucleotide substitutions on self-splicing. Here, the authors describe their results on three group I introns and one group II intron derived from yeast mitochondrial DNA.

32098 Group II intron self-splicing: development of alternative reaction conditions and identification of a predicted intermediate. Peebles, C.L. (Univ. of Pittsburgh, PA (USA)); Benatan, E.J.; Jarrell, K.A.; Perlman, P.S. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Recently, the authors have undertaken an analysis of modified reaction conditions with the intent of identifying intermediates of by-products of self-splicing reactions. In this paper, they describe additional experiments crucial to their development of these alternative conditions. Further characterization of some of the products formed under these conditions is also presented. In addition, they present evidence for IVS-E3-Lar, one predicted component of the intermediate for group II splicing. Since the other, E5, has recently been identified as a product that may be formed either by exon reopening or by hydrolysis-either under high-salt conditions as an intermediate of a trans-splicing reaction-only IVS-E3-Lar represents distinctive evidence for the intermediate. Here, they provide three lines of evidence for the IVS-E3-Lar. The putative large lariat contains a nuclease-resistant trinucleotide and a 2'-5' bond that is sensitive to debranching treatment. Its gel mobility and debranching products indicate that it contains the intron and 3' exon of the transcript from which it is derived.

32099 Characteristics of ribonuclease P from various organisms. Lawrence, N. (Yale Univ., New Haven, CT (USA)); Wesolowski, D.; Gold, H.; Bartkiewicz, M.; Guerrier-Takada, C.; McClain, W.H.; Altman, S. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Several lines of evidence indicate that RNase P (and/or the RNA subunit thereof) represents an ancient solution to the problem of processing gene transcripts, in particular tRNA gene transcripts, in vivo. The functional features of this enzyme and its substrates are represented in all cell types examined thus far and have been preserved in the solution conformation of both enzyme and substrate. Although some model substrates have been constructed that indicate what the features of the minimal substrate must be, the features that determine recognition of its substrates by RNase P, and the mechanism of the reaction are still not understood in any detail.

32100 Structure and catalytic function in ribonuclease P. Pace, N.R. (Indiana Univ., Bloomington (USA)); Reich, C.; James, B.D.; Olsen, G.J.; Pace, B.; Waugh, D.S. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Ribonuclease P (RNase P) is the enzyme responsible for removing the 5' precursor segments from tRNA during its maturation. RNase P is particularly interesting because its catalytic element is an RNA, not a protein. Although the recognition of RNase P as a catalytic RNA was preceded by the discovery of a self-splicing intron in some Tetrahymena 26S rRNA precursors, the RNase P RNA differs in an important way: it engages in intermolecular reactions. In contrast, the self-splicing intron activity in vivo is a series of intramolecular rearrangements that collectively result in the excision of the intron and the ligation of the flanking exons. RNase P therefore offers not only a model for RNA catalytic mechanisms, but also a system for exploring the nature of specific RNA-RNA recognition that almost certainly goes beyond the familiar Watson-Crick base-pairing interactions.

32101 Structural and ionic requirements for self-cleavage of virusoid RNAs and trans self-cleavage of viroid RNA. Forster, A.C. (Univ. of Adelaide (Australia)); Jeffries, A.C.; Sheldon, C.C.; Symons, R.H. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this paper, the authors report further characterization of the self-cleavage reactions of plus and minus RNA transcripts of vLTSV and show that 61 nucleotides of minus sequence are sufficient for self-cleavage. In addition, they provide data on the self-cleavage of minus RNA transcripts of ASBV by showing that two separate RNA fragments can act in trans to give specific self-cleavage.

32102 Transcripts of newt satellite DNA self-cleave in vitro. Epstein, L.M. (Florida State Univ., Tallahassee (USA)); Gall, J.G. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The eastern newt, Notophthalmus viridescens, has an abundant supply of material for studying the evolution and function of repetitive DNA. Much of the newt genome consists of repetitive sequences, some of which exist as tandemly repeated satellite DNA. Two satellite sequences from the newt have been studied in detail; these have been named satellite 1 and satellite 2. The properties of satellite 1 contrast with the remarkable features of satellite 2, the subject of this paper. This 330-bp sequence is not localized to discrete, heterochromatic chromosomal regions. Rather, tandem repeats of satellite 2 are dispersed uniformly throughout the genome. In addition, transcripts homologous to satellite 2 are found in the nuclei and cytoplasm of a variety of tissues. These transcripts correspond in size to the entire satellite-2 repeat unit or to whole multiples of the repeat. Although the authors realized it would be difficult to investigate their function, they felt encouraged to study the formation of these unusual transcripts. One model that accounts for transcripts with the size of a tandemly repeated DNA sequence is that large multimeric transcripts are cleaved to produce monomers. They present evidence for this model by demonstrating that satellite-2 transcripts undergo self-catalyzed cleavage in vitro at a specific phosphodiester bond located once within each satellite-2 repeat. This reaction is especially intriguing because it has many similarities to the self-cleavage of a number of infectious RNAs found in plants.

32103 Characterization of two RNA-catalyzed RNA cleavage reactions. Sampson, J.R. (Univ. of Colorado, Boulder (USA)); Sullivan, F.X.; Behlen, L.S.; DiRenzo, A.B.; Uhlenbeck, O.C. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The discovery that RNA molecules can have enzymatic activities has led to the speculation that the first self-replicating systems developed with RNA molecules alone. This paper presents experiments of specific RNA self-cleavage reactions that provide insight into the possible mechanism of primitive ribonucleases. The first example is the self-cleavage reaction that occurs in the hammerhead domain involved in processing the RNA genomes of certain plant viroids and satellite viruses. The second example is the Pb^{++}-dependent cleavage within the D loop of yeast $tRNA^{Phe}$. In both cases, cleavage of the phosphodiester bond is the result of a transesterification reaction, where the 2'-OH attacks the internucleotide linkage to form termini with a 2',3'-cyclic phosphate and a 5'-OH. They show that in both cases, the large rate enhancement is a consequence of the RNA chain folding into a domain that promotes the reactions. They also find that it is possible to assemble active self-cleaving domains by combining two separate RNA fragments that are joined together by short RNA helices. Specific cleavage is only observed when both fragments are present in the reaction mixture. Under conditions where strand exchange between the fragments is rapid, many rounds of cleavage occur when an excess of the cleaved strand is present. Thus, the uncleaved strand acts as a catalyst in the specific cleavage of the other strand. The fact that certain short RNA fragments can act as specific ribonucleases would aid in the generation of unique RNA molecules in the prebiotic world.

32104 Splicing of messenger RNA precursors. Sharp, P.A. (Massachusetts Institute of Technology, Cambridge (USA)); Konarksa, M.M.; Grabowski, P.J.; Lamond, A.I.; Marciniak, R.; Seiler, S.R. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

A decade has passed since the first description of RNA splicing and introns. In the interim, introns have been characterized in all lineages of eukaryotic organisms. The macromolecular structures of small nuclear ribonucloprotein particles (snRNPs) and self-splicing RNAs have been partially analyzed. These results have focused renewed attention on the role of RNA in biological systems and the evolutionary origin of genes.

32105 Different small nuclear ribonucleoprotein particles are involved in different steps of splicing complex formation. Frendewey, D. (Institute of Cell and Tumor Biology, Heidelberg (Germany, F.R.)); Kraemer, A.; Keller, W. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

To obtain further insights on the pathway of splicing complex assembly, the authors have attempted to study this process by applying the method of selective inactivation of snRNPs in splicing extracts by site-directed cleavage of their RNA moieties with RNase H and complementary oligonucleotide. This technique has been used previously to demonstrate the participation of the U1, U2, U4, and U6 snRNPs in splicing. The results indicate that inactivation of these snRNPs interferes with splicing complex formation; it also inhibits their binding to the pre-mRNA substrate. The results also show that two different domains of the U2 RNA are required at different levels of spliceosome formation, implying that U2 snRNP has a dual function in this process.

32106 Replication and evolution of short-chained RNA species replicated by Qβ replicase. Biebricher, C.K. (Max-Planck-Institut fuer Biophysikalische Chemie, Goettingen (Germany, F.R.)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

RNA that is accepted by replicase can be readily replicated in vitro; Qβ replicase is a rather stable enzyme and can be purified to homogeneity. Spiegelman and co-workers showed that RNA replicated in vitro by extraneously added replicase undergoes an evolution process that can only be interpreted as mutation and selection. Since gene expression, packaging, and other processes required in the in vivo infection cycle are neither possible for necessary, RNA molecules are selected under these conditions only for their ability to be replicated as efficiently as possible by Qβ replicase, i.e., to catalyze together with the replicase of their own replication. Because there is no need for translation, all of the extrinsic genomic information of the virus is dispensable. Template-free synthesis with Qβ replicase produces self-replicating RNA species with nucleotide chain lengths from 70 to 250 These RNA species prove to be particularly suitable for the study of in vitro evolution processes.

32107 New concepts for dealing with the evolution of nucleic acids. Eigen, M. (Max-Planck-Institut fuer Biophysikalische Chemie, Goettingen (Germany, F.R.)). pp. 14 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

If the authors asked where the transition from nonlife to life occurred, they must first refer to the conceptual level of DNA, of RNA, or of any of their self-replicating precursors. If they take any class of chemical compounds that are composed of a finite number of monomeric types, which they may call symbols, and if these symbols are lined up in linear sequences, thereby representing messages that can be read through specific interactions, then their class of compounds embodies a new property that goes beyond chemistry: This property is information. Such a quality can no longer be called typical for chemistry; it is characteristic of biology. This paper focuses mainly on reviewing some new concepts that deal with the evolution of nucleic acids.

32108 Evolution of the RNA coliphages: the role of secondary structures during RNA replication. Priano, C. (Columbia Univ., New York, NY (USA)); Kramer, F.R.; Mills, D.R. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this paper, the authors compare the synthesis of MDV-1 RNA, microvariant RNA, and CT RNA. They studied the secondary structures that they can form, the kinetics of their synthesis, the variability in their rates of chain elongation, and the propensity of their complementary strands to reassociate, both in solution and while involved in replication complexes during RNA synthesis. The results suggest that the formation of secondary structures during chain elongation of bacteriophage RNA is required for efficient autocatalytic replication.

32109 Evidence implicating a tRNA heritage for the promoters of positive-strand RNA synthesis in brome mosaic and related viruses. Marsh, L.E. (Texas A & M Univ., College Station (USA)); Hall, T.C. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Many animal viruses, and the majority of plant viruses, have an RNA-based genome. Far less is known about molecular mechanisms of replication for these viruses than is the case for viruses having a DNA genome, one reason being that RNA-based genomes have been inherently less amenable to experimental manipulation. Recently, however, considerable strides have been made in understanding this process at the molecular level for brome mosaic virus (BMV), which infects cereal grasses.

32110 Molecular events leading to poliovirus genome replication. Paul, A.V. (State Univ. of New York, Stony Brook (USA)); Yang, C.F.; Jang, S.K.; Kuhn, R.J.; Tada, H.; Nicklin, M.; Kraeusslich, H.G.; Lee, C.K.; Wimmer, E. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The genome of poliovirus is a heteropolymer of 7441 nucleotides plus a poly(A) tail (n = 60 $\pm$ 30). Nucleotides (6627) of the heteropolymeric RNA form an open reading frame of 2209 codons specifying the polyprotein. The events of adsorption, penetration, and uncoating of the virus in the initial stages of infection are poorly understood. However, once the viral RNA has entered the cytoplasm of the host cell, it associates with ribosomes and allows translation to commence 743 nucleotides downstream from the 5' end. It is surprising that an RNA virus would retain such a long sequence of a 5' noncoding region (5' NCR). It contains eight seemingly unused initiation codons before translation begins at the ninth AUG triplet. Several studies have already indicated that the sequence and secondary structures of the 5' NCR might play an important role in viral replication.

32111 Transcription and replication of influenza virion RNA in the nucleus of infected cells. Krug, R.M. (Memorial Sloan-Kettering Cancer Center, New York, NY (USA)); St. Angelo, C.; Broni, B.; Shapiro, G. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Influenza virus a negative-strand RNA virus with a segmented genome. Consequently, the virion contains the enzyme system that transcribes the virion RNA (vRNA) segments into mRNAs. The mRNAs are not full-length copies of the vRNAs, so that a different type of transcription is needed in the infected cell to generate full-length copies, or template RNAs, for replication. The synthesis of template RNAs and their subsequent copying into vRNAs require the synthesis of one or more virus-specific proteins. All steps of virus-specific RNA synthesis occur in the nucleus of infected cells. Here, the authors describe some of their recent results on the mechanism of transcription and replication of influenza.

32112 Coronavirus: a jumping RNA transcription. Lai, M.M.C. (Univ. of Southern California School of Medicine, Los Angeles (USA)); Makino, S.; Soe, L.H.; Shieh, C.K.; Keck, J.G.; Fleming, J.O. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

To understand the mechanism of leader-primed transcription and RNA recombination, the authors have further examined the structure of mouse hepatitis virus (MHV)-specific and -defective mRNA species in MHV-infected cells. They have demonstrated that MHV uses a jumping discontinuous transcription for mRNA synthesis. In addition, by analysis of RNA recombinants, they have shown that transcriptional jumping occurs frequently. Thus, RNA polymerase of MHV possesses unique properties of discontinuous and nonpossessive transcription.

32113 Switch from transcription to replication of a negative-strand RNA virus. Wertz, G.W. (Univ. of Alabama at Birmingham Medical School (USA)); Howard, M.B.; Davis, N.; Patton, J. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Replication of the RNA genomes of the negative-strand Rhabdoviridae requires de novo protein synthesis. However, transcription of these sample templates does not. In this paper, the authors describe experiments that identify the proteins involved in switching the polymerase activity from transcription to replication, and they address their possible functions. The system they have used to study the proteins involved in viral RNA replication is that of vesicular stomatitis virus (VSV), the prototype of the rhabdovirus group. VSV is one of the simplest of the enveloped, nonsegmented, negative-strand RNA viruses. The genome of VSV codes for five proteins, all of which are structural components of the virion. The RNA genome is always found in the form of a viral nucleocapsid, coated with the major nucleocapsid protein (N) and associated with the phosphoprotein (NS) and the RNA-dependent RNA polymerase (L). The remaining viral proteins are the matrix protein (M), which is located on the inside surface of the viral membrane, and the glycoprotein (G), which is embedded in the membrane. Infection initiates with adsorption of the virus to the cell membrane, followed by uptake into vacuoles and uncoating to release the viral nucleocapsid to the cytoplasm, where the subsequent molecular events of infection take place.

32114 Translational requirement for La Crosse virus S-mRNA synthesis. Kolakofsky, D. (Univ. of Geneva Medical School (Switzerland)); Bellocq, C.; Raju, R. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The genome of these viruses consists of three segments of single-stranded RNA of negative polarity, each contained within a separate nucleocapsid (NC), which are labeled small (S), medium (M), and large (L). The viral NCs have helical symmetry and appear in the electron microscope as circular and supercoiled structures. The mechanism by which bunyaviruses initiate transcription of their mRNAs is remarkably similar to that of influenza viruses. Bunyavirus S-mRNAs in vivo contain 5' nontemplated extensions of about 15 nucleotides in length that are heterogeneous in sequence, presumably the result of a host primer used to initiate transcription. In vitro, purified LAC virions were found to contain a transcriptase that is dependent on natural mRNAs. Bunyaviruses thus snatch capped oligonucleotides from host mRNAs to prime their mRNA synthesis. LAC transcription takes place in the cytoplasm, where it uses a stable pool of mRNAs as substrates for primers. The 3' end of the LAC S-mRNA, which is apparently not polyadenylated, has

been mapped to approximately position 886, 100 nucleotides before the end of its genomic template.

32115 **Molecular dynamics: applications to proteins.** Karplus, M. (Harvard Univ., Cambridge, MA (USA)); Bruenger, A.T.; Elber, R.; Kuriyan, J. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Molecular dynamics is now playing an important role in the study of the properties of macromolecules of biological interest. It can also be used effectively in the analysis of experimental data and, in particular, has been shown to provide a new approach to structure determination by NMR and X-ray crystallography. Because molecular dynamics simulations are relatively new, they have so far been employed primarily by theoreticians. It is to be hoped that experimentalists, as well, will begin to use molecular dynamics as a research tool for obtaining a deeper understanding of the biomolecules with which they work.

32116 **C-peptide helix from ribonuclease A considered as an autonomous folding unit.** Shoemaker, K.R. (Stanford Univ. School of Medicine, CA (USA)); Fairman, R.; Kim, P.S.; York, E.J.; Stewart, J.M.; Baldwin, R.L. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The following observations suggest that the C-peptide helix is an autonomous folding unit. (1) The C-peptide helix is much more stable than predicted by the Zimm-Bragg equation when host-guest data on synthetic polypeptides are used to provide the Zimm-Bragg parameters. Consequently, the C-peptide helix may be stabilized by specific side-chain interactions and its side-chain structure may be similar to that of the 3-13 helix in RNase A. (2) Additional evidence that side-chain interactions stabilize the C-peptide helix is given by the strong pH dependence of helicity. The curve of helicity versus pH, with a maximum at pH 5 and apparent pKs near 3.5 and 6.5, suggests that charged amino acid side chains are critical for helix stability. (3) The helix is localized in S-peptide and does not extend to the carboxy-terminal end. There is a helix-stop signal in S-peptide whose nature remains to be determined. In synthetic polypeptides the average length of a helical sequence at the midpoint of the helix-coil transition is about 100 residues. Thus, localization of the helix in S-peptide gave the first definite indication that it is an autonomous folding unit.

32117 **Evolution of protein structures.** Chothia, C. (MRC Laboratory of Molecular Biology, Cambridge (England)); Lesk, A.M. pp. 7 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this paper, the authors describe in outline the structural changes that occur during evolution and discuss how their nature and extent are determined by the intrinsic properties of proteins. They also show how, in distantly related proteins, where the structural differences are large, their basic functional properties are maintained by the changes in different parts of the protein being coupled so as to conserve the geometry of the active site.

32118 **β Turns in early evolution: chirality, genetic code, and biosynthetic pathways.** Jurka, J. (Harvard School of Public Health, Boston, MA (USA)); Smith, T.F. pp. 4 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

More than a decade ago, Orgel discussed plausible presence of β turns in the early protein structures stabilized by the antiparallel β-pleated sheet. Recently, β turns have been proposed as a dominant element in the early evolution of life that influenced formation of the genetic code and biosynthetic pathways of amino acids. In this hypothesis, β turns have been considered as autonomous elements somewhat independent of the context of any other protein structure. The following key assumptions underlie the idea: (1) The β turns studied currently are indistinguishable in terms of physicochemical properties from those synthesized billions of years ago; (2) the genetic code co-evolved with biosynthetic pathways of amino acids; (3) in the evolving biosynthetic pathways, synthesis of precursors was likely to precede synthesis of products. This assumption is used to elucidate ancestor-descendant relations from the precursor-product relations between amino acids.

32119 **Gene duplication and the origin of repetitive protein structures.** McLachlan, A.D. (MRC Lab. of Molecular Biology, Cambridge (England)). pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

One way to piece together the history of proteins is from their amino acid sequences, gene sequences, and intron-exon junctions. But these sequences can evolve fast and then they soon diverge beyond recognition. They cannot always take us back very far. X-ray analysis of proteins gives us structural clues that reach back into the even more distant past. This is for the simple reason that the three-dimensional folding pattern of the protein backbone evolves extremely slowly and an ancestral pattern can still be picked out long after the amino acid sequence has thrown off all trace of its origin. X-ray structures give a gallery of historical snapshots from which the authors can see how some of the most efficient types of enzyme action developed. In addition, the earliest steps of enzyme evolution were probably the same as in nonenzymes. They can therefore learn about this stage of evolution by studying the architecture of all kinds of protein molecules.

32120 **Internal packing and protein structural classes.** Ponder, J.W. (Yale Univ., New Haven, CT (USA)); Richards, F.M. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Protein folding is one of the most important and intriguing of the unsolved problems at the interface between chemistry and biology. The ability of polypeptide chains to fold into unique compact conformations with a vast array of biological functions is rare, if not unique, among high polymers. Of particular interest in the protein folding problem is the observation that similar chain conformations may bee seen for a whole series of amino acid sequences that may show little or no sequence homology. The central issue is: What is the three dimensional code? The authors are attempting to develop an algorithm that will provide a list of sequences that are compatible with a given structure. The list is called a tertiary template for the target structure. Their focus in the development of the algorithm has been a long-standing interest in intramolecular packing as a characteristics of proteins. Although this parameter can be evaluated in known structures, its predictive use in the folding problem has remained elusive, even though it should play a major role. The use of packing considerations in the development of the templates is described.

32121 **Structural and functional relationships in the adenylate kinase family.** Schulz, G.E. (Institut fuer Organische Chemie und Biochemie der Universitaet (Germany, F.R.)). pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Presently, a wide range of adenylate kinases have been characterized and are being structurally analyzed. A comparison of these data are being structurally analyzed. A comparison of these data gives new information on the substrate binding sites and on the conformational changes of the enzyme during the catalytic cycle. The species-specific properties of the enzyme are not yet understood. The glycine-rich loop of the adenylate kinases has attracted widespread interest, because it is likely to play a special role in

phosphoryl transfer. It can bind tightly a divalent anion but it is also mobile. Thus, one may speculate that this loop transports a phosphoryl group over a distance of a couple of angstroms during catalysis. The sequence of this glycine-rich loop has been found in a number of mononucleotide-binding proteins, among them the carcinogenic p21 proteins.

32122 Facing up to membranes: structure/function relationships in phospholipases. Achari, A. (Univ. of Chicago, IL (USA)); Scott, D.; Barlow, P.; Vidal, J.C.; Otwinowski, Z.; Brunie, S.; Sigler, P.B. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Phospholipases are unique enzymes in that they have evolved to attack aggregated substrates (e.g., phospholipids in a membrane). Only a trace of their full activity is exhibited against monomerically dispersed phospholipids. Moreover, phospholipase activity can be tuned by structural factors operating within the aggregate. Furthermore, perturbation of lamellar aggregates by insertion of amphipathic proteins may modulate phospholipase activity. Despite the efforts of many groups over the last three decades, there is still little consensus on how phospholipases work. This is true even of extracellular phospholipases A_2, for which four high-resolution crystal structures have been published. Yet, to elucidate in chemical terms a wide range of important cellular events, it is essential that the authors understand the complexities of enzyme action in the unique physicochemical environment created by surfaces of membranes and other physiological phospholipid aggregates.

32123 Atomic protein structures reveal basic features of binding of sugars and ionic substrates, and calcium cation. Quiocho, F.A. (Baylor College of Medicine, Houston, TX (USA)); Vyas, N.K.; Sack, J.S.; Vyas, M.N. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Seven binding proteins, each specific for L-arabinose, D-galactose/D-glucose, sulfate, leucine/isoleucine/valine, D-maltose, leucine, and phosphate are currently under investigation in the authors laboratory. Apart from the knowledge of the tertiary structures, an important component of the structural analysis concerns the mode of binding of the various substrates. Indeed, the authors have discovered novel features that have led to new and fundamental understanding of the binding of sugars and of charged substrates (e.g., sulfate, aliphatic amino acids). They have also recently unraveled a novel calcium-binding site in the D-galactose-binding protein. These findings have far-reaching importance in the understanding of electrostatic interactions, the means whereby isolated buried ionic groups are stabilized, as well as the design, chemistry, and evolution of calcium-binding sites in proteins. A description of the structural features of the various binding protein-ligand interactions is the major thrust of this paper.

32124 Zinc fingers: a novel protein fold for nucleic acid recognition. Klug, A. (MRC Lab. of Molecular Biology, Cambridge (England)); Rhodes, D. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

An essential part of gene expression and regulation is the binding of a regulatory protein to the recognition sequence of the gene on which it acts. Many such proteins have embedded in their structures a domain, or motif, that serves for binding to DNA. The best-understood protein structure used for DNA binding is the helix-turn-helix motif seen in the crystal structure of several bacterial regulatory proteins. Amino acid sequences that could form a similar structure motif are also present in the homo box region of several eukaryotic proteins. A few years ago, it was discovered in this laboratory that the Xenopus transcription factor IIIA (TFIIIA) for the 5S RNA gene contains small sequence units repeated in tandem, and it was proposed that each unit is folded about a Zn atom to form separate structural domains. Similar units have subsequently been found to be present in the amino acid sequence of other transcription factors and more generally nucleic-acid-binding proteins. Thus a second and apparently more commonly used structural motif for DNA recognition has emerged: the Zn finger.

32125 Some evolutionary relationships of the primary biological catalysts glutamine synthetase and RuBisCO. Eisenberg, D. (Univ. of California, Los Angeles (USA)); Almassy, R.J.; Janson, C.A.; Chapman, M.S.; Suh, S.W.; Cascio, D.; Smith, W.W. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The polypeptide folds of two primary biological catalysts have been determined by X-ray crystallography. One is glutamine synthetase (GS) from Salmonella typhimurium, which catalyzes the entry of nitrogen into metabolism, and the other is ribulose bisphosphate carboxylase/oxygenase (RuBisCO) from tobacco, which catalyzes the entry of carbon into metabolism. Both are oligomeric structures having complicated patterns of interdomain and intersubunit contacts. In this paper the authors consider three questions: (1) What are the patterns of folding of polypeptide chains in GS and RuBisCO, and how do the folded domains interact in the oligomeric enzyme? (2) Which features of the folding patterns are conserved in distantly related species and which are changed? and (3) What do the patterns of conservation and change tell us about the evolution of these catalytic functions?

32126 Structural and evolutionary aspects of the key enzymes in photorespiration; RuBisCO and glycolate oxidase. Braenden, C.I. (Swedish Univ. of Agricultural Sciences, Uppsala (Sweden)); Schneider, G.; Lindqvist, Y.; Andersson, I.; Knight, S.; Lorimer, G. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The authors have determined the X-ray structures of glycolate oxidase from spinach and of RuBisCO from a photosynthetic bacterium, Rhodospirillum rubrum. They have also recently obtained a high-resolution electron density map of the more complex RuBisCO from spinach and have related this map to the RuBisCO structure from Rh. rubrum. These structures will be described and discussed.

32127 Calcium coordination and the calmodulin fold: divergent versus convergent evolution. Kretsinger, R.H. (Univ. of Virginia, Charlottesville (USA)). pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this paper the author will summarize a few characteristics of the 27 proteins that contain two to six copies of the calmodulin fold. Interestingly, functions for only 10 of these have been established. Numerous noncytosolic proteins bind calcium and are not homologs of calmodulin. Given this background, he will address 8 proteins not considered to be calcium modulated, 6 of which function in extracellular environments having millimolar calcium concentrations. Their proposed calcium-binding sites resemble those of the EF-hand. Does this represent convergent or divergent evolution?

32128 Biosynthesis, processing, and evolution of bovine pancreatic trypsin inhibitor. Creighton, T.E. (Lab. of Molecular Biology, Cambridge (England)); Charles, I.G. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The original clones of bovine genome fragments encoding the primary structures of BPTI and SI were isolated with a unique sequence DNA probe of 86 nucleotides synthesized according to the amino acid sequence of BPTI. Using the BPTI genomic segment as

probe, clones were isolated that encode cDNA copies of the mRNA molecules of BPTI and SI. The remainders of the two genomic segments were then isolated, sequenced, and characterized.

32129 Design of a four-helix bundle protein. DeGrado, W.F. (E.I. du Pont de Nemours and Company, Wilmington, DE (USA)); Regan, L.; Ho, S.P. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In the authors design of a four-helix bundle protein they idealized the pseudo 2,2,2 symmetry that is found in the structures of natural four-helix bundle proteins. This provided two distinct advantages over other approaches to protein design. First, the modeling was significantly simplified; rather than designing an entire protein, it was only necessary to design a single helix, which, upon application of a 2,2,2 symmetry operator, would adopt a structure with a tightly packed interior. Second, the design of the protein could be approached in the iterative, experimental manner which is described. The first step of this approach involved the evaluation of single helices that self-assemble into homotetramers. The free energy for the self-assembly process could be conveniently monitored from the monomer-to-tetramer equilibrium constant. Evaluation of several different designs allowed optimization of the helical sequence. In the next step of the project, loops were inserted between two identical helical sequences in an attempt to prepare a helical hairpin that would assembly into a four-helix bundle. Finally, the entire sequence for the four-helix bundle was prepared by connecting four identical helices with three identical loops.

32130 Serpins: evolution and adaptation in a family of protease inhibitors. Carrell, R.W. (Univ. of Cambridge (England)); Pemberton, P.A.; Boswell, D.R. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this paper the authors provide evidence from alignments that all of the 19 serpins whose sequences are currently known share the same overall tertiary structure. However, even closely related members of the family share little more than 30% common sequence, so the question arises as to why evolution has resulted in such diversity of composition. The answer does not appear to be just the need to provide specialized inhibitory activity. This point will be considered in detail but can be illustrated by the example shown of the single mutation of the methionine at the reactive center of antitrypsin to an arginine, to give a complete switch in inhibitory activity from inhibition of elastase to inhibition of thrombin. This primary dependence of inhibitory activity on the reactive center P_1 residue, or more correctly on the P_1-P_2 residues, has been repeatedly confirmed by subsequent site-specific recombinant mutants of antitrypsin. Thus, the need for inhibitory specificity explains only a proportion of the sequence diversity of the serpins, and a significant contribution appears to arise from subsidiary functions of the molecule.

32131 Role of protein folding in the evolution of protein sequences. Stackhouse, T. (Pennsylvania State Univ., University Park (USA)); Onuffer, J.J.; Matthews, C.R.; Ahmed, S.A.; Miles, E.W. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The concept that protein folding proceeds through intermediate, partially folded forms has been gaining acceptance since Levinthal first proposed that the folding mechanism is not likely to be a random search of all possible conformations. Although the early stages of folding may involve relatively large numbers of partially folded forms, recent data on several globular proteins suggest that only a few intermediates may be present at later stages. The authors have examined the folding and stability of the α subunit of tryptophan synthase from E. coli (EC α subunit), Salmonella typhimurium (ST α subunit) and a series of hybrids produced by random combination of the structural genes for the parent proteins. The 85% homology between EC α subunit permits a test of the roles of the 40 replacements in the 268-residue polypeptide. The hybrids provide a more refined view of the effect of the replacements on folding and stability and, in addition, an interesting alternative to the construction of mutant proteins.

32132 Positive Darwinian selection in evolution of protein inhibitors of serine proteinases. Laskowski, M. Jr. (Purdue Univ., West Lafayette, IN (USA)); Kato, I.; Kohr, W.J.; Park, S.J.; Tashiro, M.; Whatley, H.E. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The purpose of this paper is to present some evidence that protein inhibitors of serine proteinases exhibit in their evolution characteristics associated with positive Darwinian selection. Although the neutral theory is now widely believed, there are still many selectionists who oppose it. However, the theory is based on or supported by five phenomenological generalizations, which are almost universally believed and which are explicitly or implicitly stated in most elementary biochemistry texts. As the authors point out later, the belief in these are so strong that it may in fact serve to thwart investigations that may challenge that belief. The five phenomenological generalizations are based on Kimura, but they are not direct quotes, in order to made them as theory free as possible. They first acquaint the reader briefly with protein inhibitors of serine proteinases and then show cases where their evolution seems to conflict with generalization of the neutral theory.

32133 Stereochemistry of cooperative mechanisms in hemoglobin. Perutz, M.F. (MRC Lab. of Molecular Biology, Cambridge (England)); Fermi, G.; Luisi, B.; Shaanan, B.; Liddington, R.C. pp. 17 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Changes in quaternary structure are initiated by changes in the allosteric core of the protein. In deoxyhemoglobin of the porphyrins are domed and the iron atoms are displaced by 0.4 Åfrom the plane of the porphyrin nitrogens, regardless of the quaternary structure of the globin. On binding O_2 or CO, the iron atoms move toward the porphyrin. These remain domed in the T structure, but flatten on transition to the R structure. As a result, on transition from deoxyhemoglobin in the quaternary T structure of oxyhemoglobin in the quaternary R structure, the iron atoms and the proximal histidines move toward the mean planes of the porphyrins by 0.5-0.6 Å. In deoxyhemoglobin in the quaternary T structure, combination of the β hemes with O_2 or CO is blocked by the distal valine; in the R structure this block is removed by a shift of the β hemes relative to helix E. In reaction intermediates, combination with O_2 or CO of the α hemes in the T structure causes the iron atoms, the proximal histidines, and their adjoining residues to move toward the porphyrin by 0.15-0.3 Å, and the porphyrins to remain domed, showing that their conformation is constrained by the globin. On combination with CO of the β hemes, a transition in tertiary structure from t_β to t_β' changes the tilt of the heme, shifts the iron and proximal histidine toward the porphyrin, and moves the distal residues away from the ligand site. On loss of heme ligands from the R structure, the transition from R to T is initiated by movements of the iron, the proximal histidines, and their adjoining residues away from the porphyrin by 0.3 Å, and by doming of the porphyrins. The doming and undoming of the porphyrins, the movements of the irons and of the proximal histidines, and, in the β subunits, the movement of the distal residues relative to the heme, are seen as the only perturbations that could set the changes

32134 Porphyrin iron(III) mixed function oxidases: an evolutionary endpoint for transition metal(III) reactions with oxygen donors. Bruice, T.C. (Univ. of California, Santa Barbara (USA)). pp. 4 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Peroxidases, catalases, and cytochrome P-450 enzymes have in common iron(III) protoporphyrin-IX as a cofactor. The reactions catalyzed by these enzymes can be, for the most part, duplicated by use of transition metal(III) porphyrins. Porphyrins serve admirably well as conjugated and rigidly planar ligands that prevent other than transformations of the ligated metal moiety at axial positions. The adjacent and distal axial positions serve to separate the enzyme-bound (distal) ligand from the reactive face (adjacent) of the iron(III). These features are not required, however, to mimic the chemical conversions that are catalyzed by peroxidases, catalases, and cytochrome P-450 enzymes. Indeed, other simple ligands may be used with a number of transition metals. Porphyrins were selected as components of living organisms at an early time, as attested to by the observation that petroleum is a rich source of porphyrins.

32135 S-Adenosylmethionine and the mechanism of hydrogen transfer in the lysine 2,3-aminomutase reaction. Frey, P.A. (Univ. of Wisconsin, Madison (USA)); Moss, M.L. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Many enzymatic reactions involve chemical transformations that cannot be brought about by the catalytic actions of the functional groups in amino acids. The enzymes catalyzing these reactions exhibit extended catalytic capabilities by virtue of the actions of coenzymes or other cofactors, which lend specific and, in many cases, reasonably well-understood physicochemical properties to the catalytic process. Enough is known about the mechanism of action of most coenzymes that the reactions in which they are involved can be recognized by their chemical types. However, certain reactions that should, on this basis, require the assistance of a particular coenzyme turn out not to involve that coenzyme. In these cases, some new, formerly unrecognized coenzyme must be present to provide the required catalytic properties. This appears to be the case with lysine 2,3-aminomutase. The authors have recently undertaken to investigate the mechanism of the lysine 2,3-aminomutase reaction, with special reference to the mechanism by which hydrogen transfer proceeds and the role of pyridoxal phosphate. They have observed the involvement of S-adenosylmethionine in hydrogen transfer in a manner reminiscent of that of adenosylcobalamin in coenzyme B_{12}-dependent rearrangements.

32136 Metal ions in proteins: structural and functional roles. Berg, J.M. (Johns Hopkins Univ., Baltimore, MD (USA)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Recognition of the importance of structural zinc has been greatly increased recently by the discovery that zinc appears to play such a role in several classes of proteins involved in nucleic acid binding and gene regulation. This development has been made possible largely by the observation that these proteins contain characteristic patterns of cysteine and histidine residues within relatively short segments of amino acid sequence, suggesting the presence of small structural domains organized around bound metal ions. The remainder of this paper will discuss the structural and functional roles of such metal-binding domains.

32137 Lactobacillus leichmannii and Escherichia coli ribonucleotide reductases: chemical and structural similarities. Lin, A.I. (Univ. of Wisconsin, Madison (USA)); Ashley, G.W.; Stubbe, J. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The present paper extends the initial studies with 2'-chloro-2'-nucleotides in an attempt to determine if the AdoCbl reductase mediates a stereospecific hydrogen shift from the 3' position of chloronucleotide to the 2' position of the 3'-keto-2'-deoxynucleotide, as has been recently shown with the E. coli reductase. In addition, an attempt has been made to identify the peptide sequence containing the redox active thiols involved in the E. coli reductase and the peptide modified by inactivation of L. leichmanni reductase by 2-methylene-3(2H)-furanone. Results from these studies again support the original hypothesis, that the enzymes are capable of similar catalytic transformations, and raise the intriguing possibility that there may be some structural similarities as well.

32138 Development of enzyme catalytic efficiency: an experimental approach. Hermes, J.D. (Harvard Univ., Cambridge, MA (USA)); Blacklow, S.C.; Knowles, J.R. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Enzymes are formidably efficient catalysts that mediate specific chemical transformations at rates rarely approached by even the best of man-made catalytic assemblies. From one angle, the challenge for the physical-organic chemist is to try to delineate the reaction mechanism and to understand the chemical and physical origins of the large rate enhancements that the authors observe. From a more biological viewpoint, however, the problem is to understand how, over evolutionary time, enzymes have become so effective. These two questions are related, of course, and if they could trace the development of catalytic efficiency, they should be better able to understand the nature of enzyme catalysis as they find it today. In this paper, they outline the first steps of an attempt to monitor the improvement in the catalytic efficiency of an enzyme as its gene is mutagenized at random and more efficient catalysts are selected.

32139 Crystallography and site-directed mutagenesis of yeast triosephosphate isomerase: what can we learn about catalysis from a simple enzyme?. Alber, T.C. (Massachusetts Institute of Technology, Cambridge (USA)); Davenport, R.C. Jr.; Giammona, D.A.; Lolis, E.; Petsko, G.A.; Ringe, D. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Although the authors combined crystallographic and mutagenesis studies have raised many new questions, they have provided some answers to the set of questions with which they began this work. Their major findings are summarized: 1. TIM is able to prevent the unwanted elimination reaction by means of a flexible loop that sterically desolvates the substrate and disfavors elimination by mass action. 2. Desolvation of the active site maximizes all electrostatic effects by reducing the effective dielectric. 3. Glu-165 acts as the catalytic base. It is held in optimal position for proton transfer by a hydrogen bond from Cys-126. Steric desolvation of the active site increases the pKa of Glu-165 when substrate binds. 4. The likely catalytic electrophiles are Asn-10, Lys-12, and His-95. 5. Acid catalysis by His-95 is not essential for isomerization. 6. Rather than a unique electrophile for each substrate oxygen, the enzyme seems to provide a positive electrostatic potential by means of a combination of side chains and α-helix dipoles. Thus it is more accurate to speak of a catalytic surface than a specific site for electrophilic catalysis. 7. Substrate specificity is chiefly provided by helical dipole and backbone hydrogen bonding to the phosphate group. 8. The active site of TIM is complementary, in both stereochemistry and charge configuration, to the transition state of the reaction it catalyzes. 9. There is not such thing as a simple enzyme.

32140 Evolution of catalysis in the serine proteases. Higaki, J.N. (Univ. of California, San Francisco (USA)); Gibson, B.W.; Craik, C.S. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The hydrolytic cleavage of peptide bonds by proteases is an ancient biochemical reaction prevalent in all forms of living organisms. Hydrolysis of a peptide substrate by a protease requires specificity in binding and catalytic efficiency. Certain constellations of amino

acid residues comprise the substrate binding pocket, which in turn confers the unique substrate specificity of each enzyme. Productive binding of the substrate in this pocket positions the scissile bond next to a characteristic set of functional amino acid residues arranged in a particular conformation to form the active site. The active-site residues polarize the peptide bond by nucleophilic attack on the carbon-oxygen bond assisted by the donation of a proton to the peptide amide nitrogen. The evolution of this highly sophisticated protein machine has been the topic of previous studies involving protein sequencing, crystallography, and enzyme kinetics. A prototypic hydrolytic enzyme that has been the subject of many of these studies is the serine protease trypsin. The authors have applied the techniques of recombinant DNA technology to this enzyme to address questions on the evolution of catalysis.

32141 Transmission of regulatory conformational changes through proteins. Thorsness, P.E. (Univ. of California, Berkeley (USA)); Mowbray, S.L.; Koshland, D.E. Jr. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Response to the external environment and to the changing internal needs of the cell is an essential feature of catalysts operating in a living system. Enzymes cannot always be turned on at full speed, since there are different needs for pathway products at various times. Two aspects of the control of catalysis are under investigation in the authors laboratory. Each reveals interesting features about the evolution of regulatory control. The first system deals with the regulation at a metabolic branchpoint that is essential for the growth of the organism. The second deals with the manner in which a receptor transmits information across a membrane barrier and integrates the response to more than one stimulus.

32142 Implications for enzymic catalysis from free-energy reaction coordinate profiles. Fierke, C.A. (Pennsylvania State Univ., University Park (USA)); Kuchta, R.D.; Johnson, K.A.; Benkovic, S.J. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The power of pre-steady techniques employing stopped-flow and rapid-quench methods or of steady-state measurements combining isotope-effect techniques has provided a number of examples of free-energy reaction profiles for differing enzymes. In this paper, the authors describe the free-energy reaction rate profiles for these enzymes; Escherichia coli dihydrofolate reductase (DHFR), the Klenow fragment of DNA polymerase I, and the mechanochemical enzymes, myosin and dynein. The analysis highlights the relationship of the free energy profiles for each enzyme to specific functions of these enzymes to optimize catalytic efficiency, nucleic acid base selectivity, or work.

32143 Kinetic devices in protein synthesis, DNA replication, and mismatch repair. Ninio, J. (Institut Jacques Monod de C.N.R.S., Paris (France)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The kinetic theory of accuracy relates the error rates in complex processes to the kinetics of substrate processing. It teaches how to read an enzyme reaction scheme and interpret it in terms of choice strategies. It successfully predicted a number of now well-established effects like the influence on replication errors at one site, of the concentration of nucleotide to be incorporated next, or the stoichiometry of GTP consumption to amino acid incorporation in protein synthesis in response to a given codon, according to whether cognate or noncognate tRNAs are used. The most publicized aspect of this theory is the concept of kinetic proofreading or kinetic amplification. The authors shall concentrate here on more elementary principles, which are at work in almost every experimental situation, and whose manifestations continue to mystify many biologists.

32144 Evolution of specificity and catalysis in subtilisin. Wells, J.A. (Genentech Incorporated, South San Francisco, CA (USA)); Cunningham, B.C.; Graycar, T.P.; Estell, D.A.; Carter, P. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Here, the authors review two strategies for altering the substrate specificity of subtilisin. Previously, the substrate specificity of subtilisin has been altered by changing enzyme residues capable of making direct contact with a bound substrate. Extending this approach, they show here the degree to which the specificity properties of two functionally and evolutionarily divergent subtilisins can be switched by exchange of substrate contact residues. In the second approach that they call substrate-assisted catalysis the catalytic His is removed and its catalytic function is restored partially by a His side chain from a bound substrate. In this case, substrates are distinguished at the level of catalysis by virtue of their ability to supply the missing catalytic function. They propose substrate-assisted catalysis as a possible evolutionary mechanism for installing the His in the catalytic triad to help explain the convergent evolution of the two serine protease families.

32145 Role of RNA and protein in ribosome function: a review of early reconstitution studies and prospects for future studies. Nomura, M. (Univ. of California, Irvine (USA)). pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Although the major research effort of our laboratory during recent years has been on the genes for ribosomal components and the regulation of their expression, the author has agreed to write an article reviewing the earlier work related to ribosome structure and function, based mostly on their own research on ribosome reconstitution from the late 1960s to the early 1970s, as well as studies on ribosome mutations in general. In addition to discussing ribosome structure and function, he has also described, in the addendum to this article, some recent observations related to the evolution of r-proteins genes, which came from their studies on the regulation of ribosome synthesis.

32146 New aspects of structure, assembly, evolution, and function of ribosomes. Nierhaus, K.H. (Max-Planck-Institut fuer Molekulare Genetik (Germany, F.R.)); Brimacombe, R.; Nowotny, V.; Pon, C.L.; Rheinberger, H.J.; Wittmann-Liebold, B.; Wittmann, H.G. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Bacterial ribosomes consist of 50-60 proteins and three (5S, 16S, and 23S) rRNA molecules. Now that the determination of the primary structure of all the ribosomal components from Escherichia coli is complete, current research is concentrating on regulation of the biosynthesis of ribosomal components, the architecture of the ribosome, principles of the ribosomal assembly and functions, and the evolutionary relatedness between components of the translational apparatus derived from various organisms. In this paper, the authors survey some of their recent contributions, with particular emphasis of the ribosomal elongation cycle.

32147 Evolving ribosome structure and function: rRNA and the translation mechanism. Oakes, M. (Univ. of California, Los Angeles (USA)); Scheinman, A.; Rivera, M.; Soufer, D.; Shankweiler, G.; Lake, J. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Major advances have been made in recent years in the authors understanding of the structure, function, and evolution of ribosomes. Among these advances one notes that the overall three-dimensional

structures of ribosomes and ribosomal subunits are known; the primary and secondary structures of the rRNAs are known for diverse organisms; the approximate locations of many ribosomal proteins (r-proteins) and of some sequences of the rRNAs are known; many aspects of ribosome function have been related to ribosome structure; and finally, comparative studies of ribosomes have revealed some of the early steps in the evolution of ribosomes and of the cells that contain them. In this chapter, they will focus on the structure and evolution of rRNA and the molecular mechanisms of protein synthesis. In light of the recent experimental emphasis on RNA this chapter emphasizes the role and the functioning of RNA in the mechanism.

32148 Slippery runs, shifty stops, backward steps, and forward hops: -2, -1, +1, + 2, +5, and +6 ribosomal frameshifting. Weiss, R.B. (Univ. of Utah Medical Center, Salt Lake City (USA)); Dunn, D.M.; Atkins, J.F.; Gesteland, R.F. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

This paper is confined to several key results from a construction project initiated several years ago, in which many lacZ frameshift windows have been built in and partially characterized. The authors focus on high-level translational shifts (> 0.1 % of in-frame levels) here for two reasons: (1) They occur quite frequently and unexpectedly during construction of specific sequences and (2) interest in the mechanisms responsible for high-level shifts has recently been augmented by several cases of high-level ribosomal shifts that are necessary for proper gene expression and whose efficiency appears to be programmed in the mRNA. The synthetic lacZ high-level shifts described here all occur within strings of repeated nucleotides (henceforth called strings) or between overlapping or nonoverlapping homologous codons. These strings and variably spaced homologous codons share the potential for correct decoding in the zero frame followed by a shift to a new frame that can be stabilized by good codon:anticodon pairing. This investigation has confirmed the location of several of these shifts and has begun to reveal a variety of event ranging from -2 to +6 nucleotides shifted relative to the zero frame. In all cases, good codon:anticodon pairing is available to the alleged shifting tRNA in both the incoming and outgoing frames, giving the paramount definition of the reading frame to the tRNA:mRNA interaction. However, mRNA sequence contexts can enhance the frequency of certain types of shifts, and the consequences of two mRNA contexts of these types of shifts are described.

32149 Studies on the architecture and function of 16S rRNA. Holler, H.F. (Univ. of California, Santa Cruz (USA)); Stern, S.; Moazed, D.; Powers, T.; Svensson, P.; Changchien, L.M. pp. 14 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this paper, the authors summarize some recent efforts aimed toward (1) understanding the molecular mechanism of assembly of 30S ribosomal subunits, (2) predicting the three-dimensional folding of the main features of the 16S rRNA structure, (3) identification of sites of interaction of 16S rRNA with tRNA, and (4) the use of antibiotics to distinguish between possible functional roles for these sites. Their approach exploits the use of chemical and enzymatic probing in conjunction with primer extension to monitor the higher order structure of rRNA and its interaction with specific functional ligands. They find evidence for interaction of twenty 30S ribosomal proteins with specific sites in 16S rRNA, and use this and other information, together with the neutron diffraction map of the locations of the corresponding proteins to construct a preliminary model for the three-dimensional folding of 16S rRNA in the 30S subunit. In addition, tRNA shields specific sites in 16S rRNA from our probes. These sites fall into three experimentally distinguishable classes; they discuss the possible mechanistic roles of these sites, and evidence for functionally relevant conformational changes in 16S rRNA. Finally, they discuss the assembly and function of the 30S subunit in the context of their preliminary structural model for 16S rRNA.

32150 Evolution of eukaryotic rRNA: constraints imposed by RNA interactions. Gerbi, S.A. (Brown Univ., Providence, RI (USA)); Jeppesen, C.; Stebbins-Boaz, B.; Ares, M. Jr. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this chapter the authors will discuss the effects of alterations within the ribosomal DNA (rDNA) genes. RNA interactions that are important for regions within rRNA impose selective constraints upon propagation of mutations within the gene. As a consequence, there are functionally important regions in rRNA that are highly conserved in primary sequence, even between different kingdoms. rRNA also has an evolutionarily conserved core secondary structure. Finally, in this chapter they will examine U3 small nuclear RNA (snRNA), and discuss whether its structure can support models of its putative interaction with the rRNA precursor.

32151 Modus operandi of the ribosome. Moore, P.B. (Yale Univ., New Haven, CT (USA)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

There are many reasons for discussing the ribosome at a symposium on the evolution of catalytic function. It is the polymerase-like enzyme that catalyzes peptide bond formation during protein synthesis. The ancestral ribosome had to have been in existence very early in evolution, at the time the genome was invented. Furthermore, ribosome action is required so that the phenotypic effect of genetic changes in an organism may be acted upon by selective forces. Thus, its properties influence the feedback that the genome gets from the environment, and hence the manner in which organisms evolve. Ribosomes are also interesting evolutionarily because their catalytic activity almost certainly depends heavily on RNA chemistry and RNA-dependent enzymes are generally regarded as primitive. Despite the fact that experiments have been done that identify protein components near virtually all the binding sites of the 30S ribosomal subunit, disappointingly few of these sites can be localized accurately with respect to the neutron map. Moreover, some of the data can be interpreted to mean that the reason precise localizations have not been obtained is because they do not exist in some cases. It is conceivable that there may be some fundamental differences between the way this RNA-based enzyme works and the modus operandi of more conventional protein enzymes. The case supporting this point of view will be made.

32152 Approaches to the determination of the three-dimensional architecture of ribosomal particles. Yonath, A. (Weizmann Institute of Science, Rehovot (Israel)); Leonard, K.R.; Weinstein, S.; Wittmann, H.G. pp. 14 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

During the last two decades a vast amount of information has been accumulated about the function and the chemical, biological, and genetic properties of ribosomes. This knowledge has shed light on the entire process of protein biosynthesis, although the understanding of the detailed mechanism of this process is still severely limited by the lack of a molecular model. Phase information is essential for maturation of crystallographic studies. The authors are currently attempting to determine phases by both conventional and novel heavy-atom techniques. A great advantage for the production of heavy-atom derivatives is the large variety of ribosomal components and the wide spectrum of materials that interact specifically with these components. In favorable cases, derivatives can be used for an unambiguous localization of specific ribosomal components. Results of electron microscopy may also contribute toward phase determination. The model of the particle under study, obtained at

medium resolution by three-dimensional image reconstruction of two-dimensional sheets, could be placed in the crystallographic unit cell using crystal-packing information derived from the electron micrographs of thin sections of the investigated crystal. This, together with information obtained from crystallographic studies of isolated individual ribosomal components at high resolution can be used for iterative phase determination by molecular replacement methods, assuming that the conformations of crystallized isolated components are similar to their conformations within the ribosome.

32153 Peptide-specific ribosomes, genomic tags, and the origin of the genetic code. Maizels, N. (Yale Univ. School of Medicine, New Haven, CT (USA)); Weiner, A.M. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Here the authors argue that the driving force for the evolution of protein synthesis was the ability of early ribosomes to synthesize useful proteins, which were not random polypeptides but essentially homopolymers. They revive the notion of the peptide-specific ribosome and propose that during a brief period in the early evolution of protein synthesis, each ribosome did in fact carry its own template. Base pairing between this internal template and a region on the tRNA defined both the location and sequence of the anticodon within the tRNA structure, thereby establishing the rudiments of the genetic code. Although a peptide-specific ribosome would not have been as versatile as a modern template-dependent ribosome, it would have had two striking viruses as a precursor of the modern protein-synthesizing apparatus. Peptide-specific ribosomes provide a pathway for the evolution of a rudimentary genetic code, as well as a plausible genetic origin for the first external templates or mRNAs.

32154 Genetic error and genome design. Reanney, D.C. (La Trobe Univ., Bundoora, Victoria (Australia)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The relationship between genetic noise and evolution has been systematically explored by Eigen and Schuster, who showed that the information-carrying capacity of any self-reproducing system is inversely proportional to the rate of copy error, according to the equation $\nu_{max} = 1n\sigma/(1 - q)$, where ν_{max} represents the upper limit of reproducible information, 1 - q the error rate per nucleotide, and σ the selective advantage of the wild type over the average of its mutant distribution. Some evolutionary consequences of this inverse relationship are presented, which compares mutation rates of modern genes with those of very early genes, as measure by the rate of incorporation of noncomplementary nucleotides in template-directed, nonenzymatic oligonucleotide synthesize in simulated pre-life experiments. As one goes back down the path of evolution, the level of error in the mechanism of genetic information transmission rises by a factor of 10^8 or about 100-millionfold. Reciprocally, the amount of sustainable information contracts from about 10^{10} to about 10^2. In follows that pressures to reduce noise were powerful determinants of genetic structure, especially during early, formative stages of evolution. In this paper, the author explores the likely effects of such high noise levels on genome design.

32155 Phylogeny of tRNA sequences provides evidence for ambiguity reduction in the origin of the genetic code. Fitch, W.M. (Univ. of Southern California, Los Angeles (USA)); Upper, K. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In 1966, Fitch proposed the ambiguity reduction hypothesis of the origin of the genetic code, based on a view that the origin of life was a process in which local (pre)biological order arose from molecular chaos on the earth, driven by the asymmetric energy budget of the earth's atmosphere, a process in which subsets of random biochemical events gradually became the programmed rule of the system. This in turn led to a view, regarding the origin of the genetic code, that suggests that originally there may have been little specificity regarding which amino acids were charged to the various RNA acceptors that paired to the message. Under such conditions, no messenger RNA is likely to produce exactly the same protein twice. The advantages of obtaining a well-defined protein sequence, however, would have gradually reduced the variability in the assignment of amino acids to codons until the current genetic code emerged. If so, the history of that reduction in ambiguity might be recorded in the phylogenetic history of the tRNAs. This suggests a test of the hypothesis. Does a correspondence exist between the pattern of the genetic code and the inferred phylogeny of the tRNAs? in this paper, the authors show that, for eight tRNAs, the correspondence is precisely of the type required by the ambiguity reduction hypothesis.

32156 Evolution of anticodons: variations in the genetic code. Jukes, T.H. (Univ. of California, Berkeley (USA)); Osawa, S.; Muto, A.; Lehman, N. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The authors have attempted to answer the following questions regarding the evolution of the genetic code. (a) Did an earlier, simpler code give rise to the universal code? (b) Is there a relationship between percentage of GC in the genome and anticodon composition? (c) Why does UGA sometimes code for typtophan instead of for chain termination? (d) Why is *CAU an isoleucine anticodon in prokaryotes but not in eukaryotes? (e) Why is IGC an arginine anticodon in eubacteria, and why are eight anticodons of this type (INN) found in eukaryotes, with only one, IGC, in eubacteria? (f) How have the mammalian mitochondrial and chloroplast codes evolved from the universal code?

32157 Role directional mutation pressure in the evolution of the eubacterial genetic code. Osawa, S. (Nagoya Univ. (Japan)); Jukes, T.H.; Muto, A.; Yamao, F.; Ohama, T.; Andachi, Y. pp. 14 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Among eubacteria, the mean guanine and cytosine (GC) contents of genomic DNA vary approximately from 25% to 75%. The phylogenetic tree to eubacterial 5S rRNA has indicated that bacterial genome GC contents are to some extent related to phylogeny. According to this tree, the gram-negative and the gram-positive bacteria diverged first. The differences in the genomic GC contents may have been caused mainly by mutation pressure, the direction and magnitude of this pressure varying among the phylogenetic lines. Such a mutation pressure, which the authors call GC/AT pressure, is due to biased mutation rates among the four bases and seems to have exerted on the entire genome during evolution. The mutations caused by GC/AT pressure are subject to selective constraints that usually eliminate functionally deleterious changes by negative selection. A certain fraction of nondeleterious mutations are then fixed in the population due to random genetic drift. Thus, functionally less important parts in the genome evolve faster than more important parts. For a given species, GC/AT pressure changes the GC content of various parts of the genome in the same direction, but to different extents, depending on their functional importance.

32158 Genetic system of chloroplasts. Ozeki, H. (Kyoto Univ. (Japan)); Ohyama, K.; Inokuchi, H.; Fukuzawa, H.; Kohchi, T.; Sano, T.; Nakahigashi, K.; Umesono, K. pp. 14 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Recently, the entire nucleotide sequence of tobacco chloroplast DNA ($\approx$ 150 kbp) has also been determined. Despite the difference in DNA size, the genetic composition and the genome organization are remarkably similar in the two chloroplasts. Accordingly, in this

paper the authors present mainly the results obtained from liverwort, but these results may be considered representative for plant chloroplasts. Detailed descriptions of liverwort chloroplast genes are published elsewhere. Of the many interesting problems in chloroplast study, they chose to focus their discussion here on the genetic system of chloroplasts, on which their functions, maintenance, and genetic continuity are based.

32159 Origin of cells: a symbiosis between genes, catalysts, and membranes. Cavalier-Smith, T. (King's College London (England)). pp. 20 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The gap between early molecular evolution and the origin of the first cell may have been bridged by a photoheterotrophic obcell, consisting of genes and ribosomes attached to the outer surface of a phospholipid vesicle containing a light-driven proton pump and a proton-driven pyrophosphate synthase. The author argues that the obcell was the substratum for the origin of DNA replication; DNA segregation by the growth and division of the peptidoglycan murein; periplasmic solute-binding proteins; bioenergetics, including the F_0F_1 proton-driven ATP synthase; active transport of calcium; and facilitated diffusion of nutrients across membranes, and that is played the major role in the replacement of ribozymes by protein catalysts. Curved growth of the peptidoglycan and a mutation causing septum formation produced and the first true cell. Evolution of porins, sodium extrusion and potassium import, conversion of the facilitated diffusion proteins to active pumps, and the evolution of intermediary metabolism, carbon and nitrogen fixation, and of substrate level phosphorylation, completed the origin of the first negibacterial eubacterium, from which all other cells evolved, and from which they have inherited most of their major catalytic properties—with the notable exceptions of reverse transcriptase, RNA splicing, and methanogenesis, all of which he believes evolved much later.

32160 Earliest phylogenetic branchings: comparing rRNA-based evolutionary trees inferred with various techniques. Olsen, G.J. (Indiana Univ., Bloomington (USA)). pp. 14 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

There are many methods for inferring evolutionary trees. Each is based on its own assumptions, so it is possible for different methods to yield different results from the same data. This paper demonstrates that when attention is paid to their underlying assumptions, it is possible to infer the same relationships with three diverse techniques: (1) a least-squares, distance matrix method, (2) maximum parsimony, and (3) evolutionary parsimony. A recurring theme is the fact that not all residues in a macromolecule undergo substitution at equal rates; i.e., some sites are more conservative than others. The analyses presented are limited to 16S rRNA sequences. The molecule is universal, constant in function (at least some functions), readily identified in diverse organisms and organelles, amenable to sequence determination, and sufficiently conservative in primary and secondary structures to permit identification of homologous positions in each sequence. In addition, the molecule is large enough to provide a significant sample of genome evolution.

32161 Prokaryotes and archaebacteria are not monophyletic: rate invariant analysis of rRNA genes indicates that eukaryotes and eocytes form a monophyletic taxon. Lake, J.A. (Univ. of California, Los Angeles (USA)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Recently, a class of rate-invariant treeing algorithms (evolutionary parsimony), not subject to the unequal rate paradox, has been developed to investigate deep evolutionary divergences. Analysis of rRNA sequences by evolutionary parsimony rejects the archaebacterial theory for the origin of eukaryotes and supports the eocyte tree. The eocyte tree indicates that eukaryotes evolved from the eocytes, a group of extremely thermophilic sulfur-metabolizing prokaryotes. The eocyte tree exhibits a fundamental bifurcation into two taxanomic divisions: a protobacterial group (parkaryotes) and a proto-eukaryotic group (karyotes). This bifucation is the deepest division separating extant organisms yet found and renders both the prokaryotic/eukaryotic grouping and the archaebacterials grouping polyphyletic. Hence, both the prokaryotic/eukaryotic and the archaebacterial classifications are improper taxanomic groupings. The tree supports the eocyte classification proposed previously and suggests that the ancestor of eukaryotes was an extremely thermophilic and sulfur-metabolizing prokaryote.

32162 Reconstruction of phylogenetic trees and estimation of divergence times under estimation of evolution. Li, W.H. (Univ. of Texas, Houston (USA)); Wolfe, K.H.; Sourdis, J.; Sharp, P.M. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

It is important to take into consideration the possibility of unequal rates among lineages when reconstructing phylogenetic trees and when dating divergence events. Phylogenetic reconstruction is extremely difficult when the rates of evolution differ greatly among lineages and when the taxa or DNA sequences under study are distantly related. The authors have studied this problem for the simple case of only four taxa. They used computer simulation to compare the performance of several methods to see which are most effective against unequal rates of evolution. It is commonly thought the phylogenetic reconstruction becomes much simpler when one or more outgroups are available. However, the usefulness of an outgroup depends on its distance from the taxa under study. They therefore studied how quickly the reliability of an outgroup reference decreases with that distance. They also studied the usefulness of adding a second outgroup. These approaches have been examined by computer simulation. How to date divergence events is challenging problem when large differences in rates occur among lineages. They have recently proposed an approximation method. The method is heuristic and so needs to be examined carefully, using both analytic and simulation approaches. Finally, they consider the branching order and divergence times among human, chimpanzee, gorilla, and orangutan, using a large amount of DNA sequence data from the four species.

32163 Reliability of evolutionary trees. Penny, D. (Massey Univ., Palmerston North (New Zealand)); Hendy, M.D.; Henderson, I.M. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In this paper, the authors describe a simple method for maximum likelihood for 2-state characters, using Hadamard matrices. Because these matrices are easily inverted, they can, for a given tree, calculate rates of evolution directly from the data. The method has allowed them to compare maximum likelihood, minimal length, and distance methods for reconstructing evolutionary trees. When the molecular clock hypothesis applies, then the minimal length method will converge on the correct tree for four taxa, but with five or more taxa, errors are possible. In general, long edges attract. Methods for overcoming this include adding a new taxa that intersect long unbranched edges, giving a higher weight to nucleotide positions that change more slowly, and testing closely related trees by maximum likelihood calculations. These methods are discussed here using biological examples.

32164 Male-driven molecular evolution: a model and nucleotide sequence analysis. Miyata, T. (Kyushu Univ., Fukuoka (Japan)); Hayashida, H.; Kuma, K.; Mitsuyasu, K.; Yasunaga, T. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

It is generally thought that the number of cell divisions in sperm cells differs greatly from that in eggs. Coupled with replication errors, this factor was shown to generate a marked difference between autosomes and sex chromosomes in mutation frequency, which is consistent with the observed pattern of evolutionary rate in highly divergent portions of genes. The authors describe the important influence this factor has had on mutation frequencies and evolutionary rates, and they suggest that males serve as mutation generators, at least in mammalian evolution.

32165 Reconstructing the evolution of vertebrate blood coagulation from a consideration of the amino acid sequences of clotting proteins. Doolittle, R.F. (Univ. of California, San Diego, La Jolla (USA)); Feng, D.F. pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

In the present study, the authors attempt to reconstruct events surrounding the appearance of the principal proteases involved in the vertebrate blood clotting by comparing the sequences of their carboxy-terminal halves. These regions have not been subject to exon exchange, so far as they can tell, and have the further advantage that they can be compared with other serine proteases not involved in blood clotting. In this regard, they have aligned the sequences of 13-15 proteases and constructed phylogenetic trees by a progressive alignment scheme designed to reflect as accurately as possible the evolutionary process. They have compared the results with both early conclusions based on comparative studies, on the one hand, and inferences made on the basis of characteristic amino-terminal domains, on the other.

32166 Globins: a case study in molecular phylogeny. Goodman, M. (Wayne State Univ. School of Medicine, Detroit, MI (USA)); Czelusniak, J.; Koop, B.F.; Tagle, D.A.; Slightom, J.L. pp. 16 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Amino acid sequences are now known for several hundred globin chains, and nucleotide sequences are now known for over 100 globin genes. The sequenced globin chains and genes represent a wide range of eukaryotes, including some plants, some invertebrates, and a large number of vertebrates. The best represented mammalian order is Primates. Nucleotide sequences on extensive flanking DNA regions in the case of ϵ-, γ-, and $\psi\eta$-globin genes for humans and other primates also exist. These comparative sequence data are a rich repository of information on the evolutionary history of both the genes and the species represented by the sequences. In the present study, as in previous ones, the authors use the maximum parsimony algorithm to extract this evolutionary information.

32167 Sequence convergence and functional adaptation of stomach lysozymes from foregut fermenters. Stewart, C.B. (Univ. of California, Berkeley (USA)); Wilson, A.C. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The authors approach to studying the molecular basis of adaptive evolution has been to compare the events concerning lysozyme that occurred on monkeys and ruminants and to contrast them with those occurring on lineages leading to organisms with simple stomachs. This bacteriolytic enzyme is expressed at high levels in the anterior region of the true stomachs of ruminants and langur and at much lower levels in most nonstomach tissues and secretions. In contrast most other mammals examined express lower levels of lysozyme in the stomach, and the chief location where expression occurs is the posterior (pyloric) region. Consistent with the regulatory hypothesis, altered patterns of lysozyme gene regulation appear to be involved in these and other cases of dietary adaptation.

32168 Exon theory of genes. Gilbert, W. (Harvard Univ., Cambridge, MA (USA)). pp. 6 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The exon theory suggests that the first genes had an intron/exon structure. The intron's role was to assemble and reassort the exons as individual elements during the formation of those genes. Over evolutionary time, simple exons are fused to make complicated ones. Can the author push this model back before the origin of DNA?

32169 What introns have to tell us: hierarchy in genome evolution. Doolittle, W.F. (Dalhousie Univ., Halifax, Nova Scotia (Canada)). pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The authors argues here that (1) although as molecular biologists we often assign evolutionary functions to parts of genomes, most such functions cannot be understood within the tenets of the modern (neo-Darwinian) synthesis; (2) that neo-Darwinian synthesis is the only theoretical framework within which the facts of molecular biology have been addressed to date; and (3) it is only when they affirm the reality of a biological hierarchy-a hierarchy in which entities at different organizational levels (genes, organisms, populations, or species) independently experience evolutionary sorting processes such as selection-that such evolutionary functions make sense. Confusion about such issues has, he believes, cropped up over and over in evolutionary speculations stemming from molecular data, the debates over the meaning of repetitive DNAs and the origins of introns being two recent examples. He will review these debates at some length, in a effort to convince the reader that this confusion is a general one. An attempt is made to show how this confusion can be relieved if we accept hierarchical views.

32170 Protein architecture and the origin of introns. Go, M. (Kyushu Univ., Fukuoka (Japan)); Nosaka, M. pp. 10 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

Two possibilities have been proposed for the origin of split structures observed in protein-coding eukaryotic genes. One is that most of the introns were positioned in their present locations in primordial genes and have served during evolution as mediators of exon shuffling to yield new functional proteins by allowing different combinations of functional units. The other is that the origin is rather new and introns were created by insertion of such DNA sequences as retroposons into eukaryotic genes. Intron-exon structures of many genes encoding large proteins are now known. They wished to investigate whether the intron positions are correlated with module junctions even in large proteins. For this purpose we extended the algorithm originally developed for identification of modules in small monolayer proteins to be widely applicable for larger proteins or domains. The boundaries of modules and those of domains can be detected simultaneously using an extended algorithm given in two versions.

32171 Exon and domain evolution in the proenzymes of blood coagulation and fibrinolysis. Blake, C.C.F. (Univ. of Oxford (England)); Harlos, K.; Holland, S.K. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

This analysis of the gene structure/protein structure relationships in the proenzymes of blood coagulation and fibrinolysis indicates that small-exon-encoded proteins units of three specific types make up the noncatalytic amino-terminal extensions of the proteins. The observed patterns in which the small protein units occur in the different proenzymes are such that no simple derivation from a single ancestral protein seems possible. It is more reasonable to see the

one or two exons that encode each small unit acting as autonomous genetic elements to be recruited into specific genes as required. The small protein units appear to carry particular binding functions, usually for other proteins in the coagulation or fibrinolytic systems, which enable the particular roles of the zymogens in the system to be specified. Through the EGF-like units, the evolutionary history of the coagulation and fibrinolytic zymogens is linked to that of the low-density lipoprotein receptor (LDLR) and the epidermal growth factor precursor (EGFP) proteins. A region encoding 400 amino acids containing three copies of the EGF-like unit is equivalent in the LDLR and EGFP genes, and as in the coagulation and fibrinolytic system, the EGF units are encoded by single exons. The LDLR protein also contains seven tandem repeats of a 40-residue unit otherwise found in the complement 9 protein. In all, the LDLR gene contains 18 exons, of which 13 encode segments homologous to those found in other proteins and which are also often encoded by separate exons. This is major evidence of exon shuffling.

32172 (DOE/ER/13526–1) **The role of transit peptides in the localization of chloropiastic proteins: Progress report.** Keegstra, K. Wisconsin Univ., Madison, WI (USA). Dept. of Botany. 1989. 10p. Sponsored by DOE Energy Research. DOE Contract FG02-86ER13526. Order Number DE89013198/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sjef Smeekens in the Utrecht group had just isolated a cDNA clone for PC and plans had been made for him to bring it to our lab to conduct import studies. In that application we proposed to examine the pathway of PC transport to the thylakoid lumen and to investigate the role of the transit peptide in that process. Additionally we proposed to begin studies aimed at investigating protein transport to the chloroplastic envelope. The progress made during the last three years in achieving these objectives is outlined below. During this grant period, we initiated some additional studies aimed at investigating the effect of known topogenic sequences on targeting within chloroplasts. Our results in these studies are also presented below. The descriptions provided in this report outline the major findings and conclusions.

32173 (DOE/ER/13729–1) **Role of acyl carrier protein isoforms in plant lipid metabolism: Progress report.** Ohlrogge, J.B. Michigan State Univ., East Lansing, MI (USA). [1989]. 3p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER13729. Order Number DE89012374/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Previous research from my lab has revealed that several higher plant species have multiple isoforms of acyl carrier protein (ACP) and therefore this trait appears highly conserved among higher plants. This level of conservation suggests that the existence of ACP isoforms is not merely the results of neutral gene duplications. We have developed techniques to examine a wider range of species. Acyl carrier proteins can be labelled very specifically and to high specific activity using H-palmitate and the E. coli enzyme acyl-ACP synthetase. Isoforms were then resolved by western blotting and native PAGE of H-palmitate labelled ACP's. Multiple isoforms of ACP were observed the leaf tissue of the monocots Avena sativa and Hordeum vulgare and dicots including Arabidopsis thallina, Cuphea wrightii, and Brassica napus. Lower vascular plants including the cycad, Dioon edule, Ginkgo biloba, the gymnosperm Pinus, the fern Anernia phyllitidis and Psilotum nudum, the most primitive known extant vascular plant, were also found to have multiple ACP isoforms as were the nonvascular liverwort, Marchantia and moss, Polytrichum. Therefore, the development of ACP isoforms occurred early in evolution. However, the uniellular alge Chlamydomonas and Dunaliella and the photosynthetic cyanobacteria Synechocystis and Agmnellum have only a single elecrophotetic form of ACP. Thus, multiple forms of ACP do not occur in all photosynthetic organisms but may be associated with multicellular plants.

32174 (LA-UR–89-1788) **Application of neural networks and other machine learning algorithms to DNA sequence analysis.** Lapedes, A.; Barnes, C.; Burks, C.; Farber, R.; Sirotkin, K. Los Alamos National Lab., NM (USA). 1988. 34p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-881276–2: Interface between computational science and nucleic acid sequencing, Santa Fe, New Mexico, USA, 12-16 Dec 1988). Order Number DE89013457/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this article we report initial, quantitative results on application of simple neutral networks, and simple machine learning methods, to two problems in DNA sequence analysis. The two problems we consider are: (1) determination of whether procaryotic and eucaryotic DNA sequences segments are translated to protein. An accuracy of 99.4% is reported for procaryotic DNA (E. coli) and 98.4% for eucaryotic DNA (H. Sapiens genes known to be expressed in liver); (2) determination of whether eucaryotic DNA sequence segments containing the dinucleotides "AG" or "GT" are transcribed to RNA splice junctions. Accuracy of 91.2% was achieved on intron/exon splice junctions (acceptor sites) and 92.8% on exon/intron splice junctions (donor sites). The solution of these two problems, by use of information processing algorithms operating on unannotated base sequences and without recourse to biological laboratory work, is relevant to the Human Genome Project. A variety of neural network, machine learning, and information theoretic algorithms are used. The accuracies obtained exceed those of previous investigations for which quantitative results are available in the literature. They result from an ongoing program of research that applies machine learning algorithms to the problem of determining biological function of DNA sequences. Some predictions of possible new genes using these methods are listed – although a complete survey of the H. sapiens and E. coli sections of GenBank will be given elsewhere. 36 refs., 6 figs., 6 tabs.

32175 (NEI-DK–166) **Use of hemicellulose hydrolate in the production of fatty acids.** Hamann Spendler, F. Teknologisk Inst., Taastrup (Denmark). Bioteknik. Jun 1988. 65p. (In Danish). Order Number DE89766868/JAW. Available from NTIS (US Sales Only), PC A04/MF A01;1.

EFP-87.

Cellulose fibers can be produced from straw by an organosolve process or similar week acid hydrolysis. The hydrolysate sugars can further be converted to volatile fatty acids by fermentation. The composition of the hydrolysate was analyzed. Xylose was predominant, but in a lower contration than expected from the overall COD-content. This study has shown that if the fermentation is carried out in a fixed film reactor, composition of the acid mixture in the broth yield and conversion speed are strongly dependent on pH and retention time. The production of the more valuable acids, such as lactic acid and butyric acid is favored by a pH around 6,0. Lactid acid should be produced at low retention times of app. 4 hours or less, whereas butyric acid requires retention times of 40 - 60 hours. Attempt to recover the acids by extraction with a solvent compose of tertiary amines and nonylphenol did not prove to be succesful. Other ways of recovering the acids reported in the litterature have been studied and are going to be tested out in the second phase of the project.

32176 **Process of labeling specific chromosomes using recombinant repetitive DNA.** Moyzis, R.K.; Meyne, J. To Dept. of Energy. USA Patent 7-155,451. 12 Feb 1988. 17p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89011800/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Chromosome preferential nucleotide sequences are first determined from a library of recombinant DNA clones having families of repetitive sequences. Library clones are identified with a low homology with a sequence of repetitive DNA families to which the first clones respectively belong and variant sequences are then identified by selecting clones having a pattern of hybridization with genomic DNA dissimilar to the hybridization pattern shown by the respective families. In another embodiment, variant sequences are selected from a sequence of a known repetitive DNA family. The selected variant sequence is classified as chromosome specific, chromosome preferential, or chromosome nonspecific. Sequences which are classified as chromosome preferential are further sequenced and regions are identified having a low homology with other regions of the chromosome preferential sequence or with known sequences of other family members and consensus sequences of the repetitive DNA families for the chromosome preferential sequences. The selected low homology regions are then hybridized with chromosomes

to determine those low homology regions hybridized with a specific chromosome under normal stringency conditions.

32177 Antibody-gold cluster conjugates. Hainfeld, J.F. To Dept. of Energy. USA Patent 7-212,545. 28 Jun 1988. 27p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89011808/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Antibody- or antibody fragment-gold cluster conjugates are shown wherein the conjugate size can be about 5.0 nm. Methods and reagents are disclosed in which antibodies or Fab' fragments thereof are covalently bound to a stable cluster of gold atoms. 2 figs.

32178 Long distance electron transfer. Larsson, S. (Chalmers Univ. of Technology, Goeteborg (Sweden)); Broo, A.; Kaellebring, B.; Volosov, A. pp. 22 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Quantum mechanical models to treat long distance electron transfer are being developed. The model is based on the theory of R.A. Marcus. The authors contribution is in the calculation of the electron coupling factor κ. Estimations of the latter number, as well as the bond and solvent relaxation energies, λ_i and λ_0, respectively, are necessary to be able to calculate the rate constant for a reaction of the conductivity in an electric field. κ may be approximately calculated from orbital energy differences at avoided crossings between orbitals localized in different parts of the system. A novel spectroscopic NDO method is suggested in which one may include any atom of the periodic table. Another problem discussed is the inclusion of electronic relaxation effects of the solvent or protein in the calculation. Applications are made to systems where metal ions are connected by organic bridges of different kinds such as dipyridine with coplanar and perpendicular pyridyl groups. As expected the electronic factor depends strongly on the conformation of the bridge. A strong conformational dependence is also obtained for a saturated bridge of the type $NH_2 \times (CH_2)_n \times NH_2$. In another study they use an α helix as a bridge between two metal ions. If one glycine in this α-helix is substituted by phenylalanine the electronic factor increases by factors of 1.5-10. It is suggested, however, that larger enhancement factors are possible if an aromatic group is positioned in a favorable way. The CNDO/S method is used to study the charge separation process in a bichromophoric molecule and in the reaction center (RC) of Rhodopseudomonas viridis.

32179 Influence of geometrical fluctuations on electron tunneling barriers in proteins. Sneddon, S.F. (Carnegie-Mellon Univ., Pittsburgh, PA (USA)); Brooks, C.L. III. pp. 10 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

The authors have recently developed a new classification of the amino acid side chains based on doublet acceptor energy levels (DALs). These energy levels, taken as the eigenvalue of the highest occupied molecular orbital in the radical anion, provide insight into the shape of the tunneling barrier in protein electron transfer. The authors have used this classification to characterize several transfer pathways in myoglobin. The authors present here a study of the effect of changes in geometry on the doublet acceptor levels. They find that, in general, this influence is rather small for reasonable changes in bond lengths and angles (e.g., those resulting from thermal fluctuations in the protein structure). However, they have found that for serine, threonine and water, changes in geometry that might take place as a result of fluctuations in hydrogen bond geometries lead to rather large changes in DAL. They investigate these correlations in some detail. The relation between protein fluctuations and changes in the shape of the electron tunneling barrier is discussed. Additionally, based on the energetics of changes in the OH bond distance, they discuss aspects of the relation between electron transfer and proton transfer.

32180 Shape description of conformationally flexible molecules: application to two-dimensional conformational problems. Arteca, G.A. (Univ. of Saskatchewan, Saskatoon (Canada)); Mezey, P.G. pp. 22 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Nuclear configuration and molecular shape are two different concepts. The former refers to the geometry of the nuclear framework, whereas the shape of a molecule is better represented by a molecular envelope surface enclosing the nuclei. Nevertheless, there exist relationships between the molecular shape and the conformational arrangement of the nuclei. For certain changes in the nuclear geometry, the shape of a molecular surface does not change significantly, whereas for some others it may undergo essential topological changes. The characterization and interrelations of these changes provide a rigorous classification of reaction paths and conformational rearrangements for flexible molecules in terms of shape features. In this article the authors use a recently introduced topological tool to study molecular shape and molecular conformations: the shape groups (symmetry-independent homology groups) of a molecule. Van der Waals surfaces are considered as illustrative examples of molecular surfaces. They study the changes in the shape of van der Waals surfaces of hydroquinone, resorcinol, and catechol for a number of two-dimensional conformational problems, where the nonrigid conformational paths have been calculated at the STO-3G ab initio Hartree-Fock level.

32181 Energy-conformational studies of β-endorphins: identification of plausible folded conformers. Loew, G. (SRI International, Menlo Park, CA (USA)); Collins, J.; Payne, P.; Judd, A.K.; Wacknow, K.H. pp. 12 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

β-Endorphins are 31 amino acid endogenous opioid peptides with higher receptor affinity and antinociceptive activity. Because of their importance as neurohormones and the significant experimental effort that has been made to understand their structure activity profiles, the authors have begun to develop procedures that could be useful first to identify low-energy conformers of β-endorphins and ultimately their bioactive form. In the initial studies reported here, they have identified plausible initial structures of the full peptide by calculating and comparing the conformational preference of all possible extended tetrapeptide fragments of β-endorphin starting from each of the first 28 residues. Comparison of fragment energies suggested two types of compact folded β-endorphin conformers were plausible: a helix-turn-helix and an antiparallel β-sheet conformer. These structures, as well as an extended α-helical and β-strand conformer, were assembled and total geometry optimization performed using the empirical-energy-based program AMBER. The results yield an α-helical structure as the lowest energy form consistent with recently reported NMR studies of β-endorphin. The two more compact folded structures obtained, however, are reasonable starting conformations for further planned molecular dynamics simulation studies and could yield competing low-energy structures as candidates for the bioactive form of these peptides.

32182 Electrostatic interactions and conformation of some thromboxane antagonists. Wilkinson, A.J. (ICI Pharmaceuticals plc, Cheshire (England)); Warwick, C.M.; Davies, R.H. pp. 18 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

A class of thromboxane antagonists exists where the prostaglandin side chain containing the C_{16} hydroxyl moiety is replaced by a phenyl ring, and the bridged six-membered pyranose

moiety by cyclohexane, pyranose and dioxane ring systems. Analysis of antagonist potency data in terms of a binding constant model previously used for membrane bound receptor-drug interactions shows that the major patterns of antagonist potency are governed as much by axial/equatorial conformer preference of the phenyl moiety and its orientation as by electrostatic effects of the aliphatic ring oxygen atoms. The conformational restriction of the two substituted side chains of the σ-bonded 6-membered ring is shown to be a primary requirement for binding to thromboxane receptors, and a quantitative separation of electrostatic and conformational components in the potency data is attempted.

32183 Electrostatics and molecular recognition. Richards, N.G.J. (Southampton Univ. (England)). pp. 9 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

This short communication outlines preliminary work aimed at understanding the recognition of sialylated oligosaccharides by influenza virus hemagglutinin. Initial efforts to model the complex have used the electrostatic interactions between atoms in the binding pocket and as a means of constraining the conformational search in docking these two molecules. Some important features of the lowest energy structure are discussed.

32184 Conformational basis of the receptor-binding potency of normal and mutant insulin molecules with relevance to the pathophysiology of noninsulin dependent diabetes mellitus (NIDDM). Rao, G.S. (All India Institute of Medical Sciences, New Delhi); Bajaj, J.S. pp. 7 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Residues 23-26 (Gly-, Phe-, Phe-, Tyr) of the B-chain of insulin constitute a critical area of the receptor-binding region of the molecule. Three chemically distinct mutant insulins have recently been identified in patients with NIDDM, each involving substitution of either B24 of B25 phenylalanine. Two of the mutations have been unambiguously characterized: a B25 phenylalanine-to-leucine substitution [B25(Phe → Leu)], and the other, a B24 phenylalnine-to-serine [B24 (Phe → Ser)]. The authors have calculated the preferred conformations of normal and mutant insulins using a global optimization method developed by them earlier. The mutant insulins exhibit significant alterations in conformation and in the average distances between amino acid side-chains as compared to normal insulin. Therefore, the decreased binding affinity of mutant insulin could be either due to an alteration in the nature of the substituted residue (hydrophilic in place of hydrophobic) or to the alteration in one or more critical side-chain distances in the case of a hydrophobic to hydrophobic substitution.

32185 Crystal and molecular structure of a nickel isobacteriochlorin derived from a chlorophyll. Barkigia, K.M. (Brookhaven National Lab., Upton, NY (US)); Fajer, J.; Goff, D.A.; Smith, K.M. v.v of Proceedings of the American Crystallographic Association. American Crystallographic Association, New York, NY (1986). (CONF-850877–: American Crystallographic Association meeting, Stanford, California, USA, 18-23 Aug 1985).

A nickel isobacteriochlorin, synthesized by the Raney nickel reduction of a chlorophyll derivative, methyl mesopyropheophorbide a, has been crystallized and its structure solved by X-ray diffraction. Because of its hybrid nature, the compound serves as a model for porphyrins involved in photosynthesis (chlorophylls) nitrite and sulfite reductases (isobacteriochlorins) and in methanogenesis (F430). Its particularly distorted conformation provides clear evidence of the flexibility of the hydroprophyrin skeleton. Such conformational variations following electron transfer may provide a mechanism for altering distances between molecules in vivo and thereby control back reaction rates. The compound NiN/sub 4/O/sub 3/C/sub 34/H/sub 38/, crystallizes from dichloromethane-hexane in tetragonal space group I4/sub 1/in a unit cell of dimensions a = b = 30.852(6), c = 13.357(3) A, with Z = 16. A total of 18312 reflections were collected on an Enraf-Nonius CAD-4 diffractometer using CuKα radiation, and averaged to give 8064 unique reflections and 4307 with F/sub 0//sup 2/> 3σF/sub 0//sup 2/. The structure was solved with MULTAN 78 and refined in two blocks using full-matrix least squares to a current value of R/sub F/2 = 0.09.

32186 Continuum electrostatics and hydration phenomena. Rashin, A.A. (City Univ. of New York, NY (USA)). pp. 16 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

A formalism for a computational treatment of the polarization of a solvent and polar solutes immersed in it is presented. The solvent is modeled as a continuum dielectric. Polarization effects are represented by a polarization charge density at the dielectric boundaries and by induced dipoles at the polarizable atoms. Applications of this formalism with nonpolarizable atoms have led to excellent agreement between the calculated and experimental hydration enthalpies of a variety of polar molecules. A problem of the choice of the charge distribution of the solute is addressed in calculations of the solution dipole moment and hydration enthalpy of polarizable molecule of water in solution. Experimental values of these properties were well reproduced in calculations starting with point charges fitted to the vacuum dipole moment of the water molecule. Tests calculations for spherical models and for a 13-residue peptide show good convergence of the computational method. It is shown in calculations on simplified models that a change in the exposure of a charged side chain can lead to large changes in the potential inside protein measured at a fixed distance from the change and at the same depth from the protein surface. Calculations performed for the C-peptide of the ribonuclease suggest that the differential screening of partial charges can reverse the sign of the vacuum potential of the helix dipole.

32187 Ab initio molecular orbital study of hydrogen bonding and ion-molecule association in model systems for DNA bases. Del Bene, J.E. (Youngstown State Univ., OH (USA)). pp. 17 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194–: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Ab initio calculations have been performed to investigate hydrogen bonding and ion-molecule association in complexes of H_2O with the neutral, protonated, and Li^+ complexes of N-formylformaldehyde and N-formylformamidine. In the complexes with the neutral bases, H_2O assumes an in-plane bridging position in the amide and amidine regions. The most stable complex is the bridging N-formylformamidine-H_2O complex in the amidine region, which has an MP2/6-31 + G(d,p) binding energy of -9 kcal/mol. Hydrogen bonded complexes of H_2O with the oxygen-protonated bases have open structures with the protonated bases as proton donors, and binding energies ranging from -16 to -24 kcal/mol. Nitrogen protonation of N-formylformamidine leads to an equilibrium chelated hydrogen bonded structure with a stabilization energy of -21 kcal/mol. When Li^+ associates with these bases at a carbonyl oxygen, hydrogen-bonded bridging structures with H_2O reappear, and wobble complexes exist in the amide and amidine regions of N-formylformaldehyde and N-formylformamidine. These complexes have binding energies of -13 to -14 kcal/mol. However, the most stable complex has H_2O directly bonded to Li^+, with an MP2 binding energy of -30 kcal/mol. No hydrogen bonded structures of H_2O with N-formylformamidine exist in the amide region when Li^+ associates with this base at the C=N group. Hydrogen bond energies computed at the single-determinant Hartree-Fock level with the 6-31G(d) basis set approximate correlated MP2/6-31 + G(d,p) energies to within 1 kcal/mol for all of the neutral and charged complexes. However, when H_2O is bonded to Li^+, HF/6-31G(d) association energies overestimate MP2/6-31 + G(d,p) energies by 3 kcal/mol.

32188 Effects of external ions upon proton transfer reactions: H-bonded systems containing HCOOH. Scheiner, S.

(Southern Illinois Univ., Carbondale (USA)); Das, T. pp. 11 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Ab initio calculations reveal that a cation, in a position equidistant from the two H-bonding oxygen atoms of $(HC(OH)O \times H \times OH_2)^+$, acts to push the proton from HCOOH toward OH_2 if the ion is located near the -OH or C-H group of HCOOH. In contrast, rotation of the cation out of the HCOOH plane, while maintaining its position relative to the two H-bonding atoms, leads to a potential which is little different than that observed in the absence of an ion. These findings are readily explained on the basis of ion-induced internal polarization of the subunit to which the ion is closer. Replacement of OH_2 by HCOOH suggests that polarizations of the more distant subunit can also be a factor.

32189 3- and 5-isoxazolol zwitterions: a model of interaction with the GABA-A receptor relating to agonism and antagonism. Boulanger, T. (Facultes Universitaires Notre-Dame de la Paix, Namur (Belgium)); Vercauteren, D.P.; Durant, F.; Andre, J. pp. 17 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Using molecular orbital methods, the authors propose various models of interactions between GABA or analogs (TACA, muscimol, isomuscimol) and a hypothetical receptor molecular fragment, a methylguanidinium ion. The respective geometries of the GABA-, TACA-, muscimol-, and isomuscimol-methylguanidinium ion complexes are optimized using the semi-empirical MNDO method. Stabilization energies of the complexes obtained by substraction of the heats of formation of the optimized complexes from those of the optimized isolated molecules differentiate the behavior of the anionic heads between the agonist and antagonist compounds. Affinity and stabilization are confirmed by computing ab initio STO-3G ionization potentials and interaction energies taking into account counterpoise corrections. Results show a decrease of the interaction energy from GABA and TACA to isomuscimol, via muscimol. The low interaction energy of the 5-isoxazolols as isomuscimol compared to the 3-isoxazolols, as muscimol, may explain their antagonist character.

32190 Possible mode of regulation of DNA transcription by steroid hormones: glucocorticoids. Kothekar, V. (All-India Institute of Medical Sciences, New Delhi); Mrigank; Kotwal, A.; Chandrashekhar, B. pp. 12 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

The authors present models for the interaction of glucocorticoids: dexamethasone (DEX), dexamethasone-21-mesylate (DEXM) and deacylcortivazol (DAC) with the hexanucleotide sequence $d(TGTTCT)_2$ (CORE sequence) found in the long terminal repeat of MMTV. These models are obtained by computer-aided geometry simulation with energy minimization technique, making use of the empirical potential energy functions. The authors have considered both intercalative and nonintercalative binding. Differences in the glucocorticoid activity of these steroids are explained on the basis of stereochemical and energetic differences. A model is proposed for interaction of the steroid-receptor complex with the hormone-responsive element (HRE).

32191 Thermodynamic calculations on biological molecules. Brooks, C.L. III (Carnegie-Mellon Univ., Pittsburgh, PA (USA)). pp. 14 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Application of free-energy simulation methods to the calculation of thermodynamic properties for biologically relevant processes will be presented. Attention will be given to the usefulness of thermodynamic methods to explore the accuracy of empirical energy functions. Calculations of aqueous hydration and binding thermodynamics for drug molecules (trimethoprim and other related compounds) to biological targets (the enzyme dihydrofolate reductase) will be presented. In these applications the author will discuss differences in binding modes for different drugs and the ability of thermodynamic methods to predict these changes. Finally, comments will be made regarding the free energy derivative methods and coordinate-coupled free energy calculations.

32192 Free energy (chemomechanical) transduction in elastomeric polypeptides by chemical potential modulation of an inverse temperature transition. Urry, D.W. (Univ. of Alabama, Birmingham (USA)). pp. 11 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Data and analyses are presented on the first synthetic polypeptide system to exhibit mechanochemical coupling; the mechanochemical coupling can also be demonstrated to be both polymer-based and solvent-based with respect to where the result of the change in the chemical potential is focused. Both polymer-based and solvent-based processes are the result of chemomechanical transduction in which the change in chemical potential results in a change in the temperature at which an inverse temperature transition occurs. In the polymer-based process, the contraction/relaxation occurs due to a change in the chemical nature of the polypeptide; in the solvent-based process there is no change in the chemical nature of the polypeptide on contraction or relaxation, but rather the change in chemical potential changes the state of hydration of the polypeptide. The new mechanochemical system provides an experimental system with which to clarify and to quantitate what may be called aqueous mediated apolar-polar interaction energies in polypeptides and proteins with hydrophobic groups that may be variously exposed to the aqueous solution or buried within the folded polypeptide or protein. Furthermore, it is noted that any conformational change exhibited by a polypeptide or protein that is the result of a binding of a chemical moiety, the change in chemical nature of a bound moiety or the change in chemical potential of the medium can be viewed in terms of mechanochemical coupling or chemomechanical transduction.

32193 Approximation of the Planck-Benzinger thermal work function in protein refolding in ribonuclease systems. Chun, P.W. (Univ. of Florida, Gainesville (USA)). pp. 12 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

In reexamining the thermodynamic parameters of the protein refolding of ribonuclease systems over the temperature range of 220-360° K, based on the Nernst heat theorem, the authors found that at the temperature (T_s), the thermodynamic quantities $\Delta G^0(T_s)$ and $\Delta H^0(T_s)$ are of the same magnitude, while $T\Delta S^0(T_s)$ approaches zero. Based on the Planck-Benzinger thermal work function, $\Delta W^0(T) = \Delta H^0(T_0) - \Delta G^0(T)$. Therefore, $\Delta H^0(T_0) = \Delta W^0(T_s) + \Delta G^0(T_s) + \Delta G^0(T_s)$ at (T_s). Within the limits of statistical error, plotted values for $\Delta H^0(T_0)$ at 0°K and (T_s) are equivalent for each of the three ribonuclease systems the author examined. Error-minimizing statistical simulation suggests that a reasonable a priori estimation of $\Delta H^0(T_0)$ can be made at (T_s), provided that the expansion coefficient of the Planck-Benzinger thermal work function is accurately determined. Values for $\Delta H^0(T_0)$ at (T_s) were determined to 34.05 ± 1.30 and 19.49 ± 0.42 kcal/mol in 20-S_1 [I] and 14-S_1 [II] is an effective measure of the ease with which these molecules can be refolded to resemble the native protein structure, with greatest ease of folding at the lowest chemical bond energy. The Planck-Benzinger thermal work function, $\Delta W^0(T)$, is an effective measure of the energy potentially available for any interaction to take place.

32194 Rational selection of graph-theoretical indices in the QSAR. Randic, M. (Drake Univ., Des Moines, IA (USA)); Sabljic, A.; Nikolic, S.; Trinajstic, N. pp. 19 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

In this paper the authors have addressed an important problem: how to develop a strategy for identification of the topological indices which are most important in establishing a model for structure-activity analysis. In particular they consider a rational selection of graph theoretical (topological) indices in QSAR. The approach is illustrated by the study of the toxicity of ethers on mice. The indices examined include the connectivity indices based on adjacency matrix, the conceptually related graph distance indices, and an information theoretic index based on partitioning of electrons in various domains. They have outlined the similarities and differences and discuss advantages and limitations among different approaches. Their emphasis is on the problem how to select in a rational way appropriate graph-theoretical descriptors and how to introduce higher corrections in order to improve derived correlation.

32195 Quantum mechanics and molecular computing: mutual implications. Conrad, M. (Wayne State Univ., Detroit, MI (USA)). pp. 15 of Proceedings of the international symposium on quantum biology and quantum pharmacology. Loewdin, P.O.; Oehrn, N.Y.; Sabin, J.R.; Zerner, M.C. (eds.) John Wiley and Sons, Inc., New York, NY (1988). (CONF-8803194--: International symposium on quantum biology and quantum pharmacology, Marineland, Florida, USA, 12-19 Mar 1988).

Proteins and other macromolecules may be viewed as shape-based (or tactile) pattern recognizers. Biological cells exploit this inherent capability by transducing macroscopic signal patterns impinging on the external membrane to microscopic patterns at the molecular level, via second messengers. The parallelism inherent in the wave function description of these microscale processes in effect serves to increase the computing power of molecular computing systems as compared to macroscopic analogs. The conversion and recognition process is highly reminiscent of measurement. The linking role of second messengers allows macroscopic signals to set the state of the cell (in analogy to state preparation), while enzymatic readout and control of cellular behavior is an amplification process that corresponds to measurement of the microstate at a later point of time. Since the standard time evolution equations are reversible and unitary, while measurement is not, it is conceivable that the study of molecular computing will lead to new insights into the relation between the microworld and the macroworld. The model presented suggests that projection processes that are masked in ordinary laboratory systems are brought to macroscopic significance by the highly nonlinear chain of amplification events in the biological cell.

32196 Site-directed mutagenesis identifies a tyrosine radical involved in the photosynthesized oxygen-evolving system. Debus, R.J. (Michigan State Univ., East Lansing (USA)); Barry, B.A.; Babcock, G.T.; McIntosh, L. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(2): 427-430 (Jan 1988). DOE Contract AC02-76ER01338.

Photosynthetic oxygen evolution takes place in the thylakoid protein complex known as photosystem II. The reaction center core of this photosystem, where photochemistry occurs, is a heterodimer of homologous polypeptides called D1 and D2. Besides chlorophyll and quinone, photosystem II contains other organic cofactors, including two known as Z and D. Z transfers electrons from the site of water oxidation to the oxidized reaction center primary donor, P_{680}^{+}, while $D^{\cdot +}$ gives rise to the dark-stable EPR spectrum known as signal II. $D^{\cdot +}$ has recently been shown to be a tyrosine radical. Z is probably a second tyrosine located in a similar environment. Indirect evidence indicates that Z and D are associated with the D1 and E2 polypeptides, respectively. To identify the specific tyrosine residue corresponding to D, the authors have changed Tyr-160 of the D2 polypeptide to phenylalanine by site-directed mutagenesis of a psbD gene in the cyanobacterium Synechocystis 6803. The resulting mutant grows photosynthetically, but it lacks the EPR signal of $D^{\cdot +}$. The authors conclude that D is Tyr-160 of the D2 polypeptide. They suggest that the C_2 symmetry in photosystem II extends beyond P_{680} to its immediate electron donor and conclude that Z is Try-161 of the D1 polypeptide.

32197 Construction of a mutagenesis cartridge for poliovirus genome-linked viral protein: isolation and characterization of viable and nonviable mutants. Kuhn, R.J. (State Univ. of New York, Stony Brook (USA)); Tada, H.; Ypma-Wong, M.F.; Dunn, J.J.; Semler, B.L.; Wimmer, E. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(2): 519-523 (Jan 1988).

By following a strategy of genetic analysis of poliovirus, the authors have constructed a synthetic mutagenesis cartridge spanning the genome-linked viral protein coding region and flanking cleavage sites in an infectious cDNA clone of the type I (Mahoney) genome. The insertion of new restriction sites within the infectious clone has allowed them to replace the wild-type sequences with short complementary pairs of synthetic oligonucleotides containing various mutations. A set of mutations have been made that create methionine codons within the genome-linked viral protein region. The resulting viruses have growth characteristics similar to wild type. Experiments that led to an alteration of the tyrosine residue responsible for the linkage to RNA have resulted in nonviable virus. In one mutant, proteolytic processing assayed in vitro appeared unimpaired by the mutation. They suggest that the position of the tyrosine residue is important for genome-linked viral protein function(s).

32198 Preparation and characterization of soluble macronuclear chromatin from the hypotrich Euplotes eurystomus. Cadilla, C.L. Harp, J. (Oak Ridge National Lab., TN (USA)); Flanagan, J.M.; Olins, A.L.; Olins, D.E. *Nucleic Acids Research (UK),* 14(2): 823-841 (24 Jan 1986). DOE Contract AC05-84OR21400.

Euplotes eurystomus is a hypotrichous ciliate containing a transcriptionally active macronucleus (MAC) and a transcriptionally inactive micronucleus. Soluble MAC chromatin contains a normal complement of inner histones, an H1-like protein which is very sensitive to proteolysis, and a considerable proportion of non-histone proteins. A combination of N-Tosyl lysine chloromethyl ketone (TLCK) and PMSF was found to be most effective in preventing proteolysis. Micrococcal nuclease digestion yielded an average nucleosome repeat length of 187 $\pm$ 25 bp for soluble chromatin; and 190 $\pm$ 9 bp for isolated macronuclei. Thermal denaturation profiles for MAC chromatin in 0.25 mM EDTA display two main transitions at about 76 and 83°C, resembling the melting of soluble chicken erythrocyte chromatin. Circular dichroic spectra of MAC chromatin were compared to soluble chicken erythrocyte chromatin under the same ionic strength conditions and were found to be very similar. 2D chromatin/DNA agarose gel electrophoresis resulted in a diagonal line of DNA staining, which establishes a strict correlation between DNA and chromatin electrophoretic mobility.

32199 Regulation of the rat metallothionein-I gene by sodium butyrate. Birren, B.W. (Univ. of California, Los Angeles (USA)); Herschman, H.R. *Nucleic Acids Research (UK),* 14(2): 853-867 (24 Jan 1986). DOE Contract AC03-76SF00012.

Sodium butyrate selectively induces accumulation of metallothionein-I (MT-I) RNA in H4IIE rat hepatoma cells. The induction is rapid; significant elevation in cytoplasmic MT-I RNA can be observed within three hours after exposure to 5 mM butyrate. Maximal levels of MT-I RNA are obtained after eight hours. Butyrate stimulates MT RNA accumulation in the absence of de novo protein synthesis, indicating that MT induction by butyrate is not a distal step in a cascade of gene activation events. Butyrate blocks the induction of tyrosine amino transferase by dexamethasone. In contrast, butyrate and dexamethasone induced MT RNA elevations are additive. Butyrate induced MT-I RNA transcripts initiate at the correct start site. Measurements of the transcriptional activity of the MT-I gene indicate that butyrate stimulates MT-I transcription. The rapid, direct nature of the induction of MT-I by butyrate, combined with the extensive characterization of the metallothionein gene, provide an excellent system in which to study the effects of butyrate on a small, well-defined, responsive region of chromatin.

32200 Site-specific single strand endonuclease activity induced by NYs-1 virus infection of a Chlorella-like green alga.

Xia, Y. (Univ. of Nebraska, Lincoln (USA)); Morgan, R.; Schildkraut, I.; Van Etten, J.L. *Nucleic Acids Research (UK),* 16(20): 9477-9487 (25 Oct 1988).

A site-specific endonuclease was isolated from a eukaryotic Chlorella-like green alga infected with the dsDNA-containing virus NYs-1. The enzyme recognizes the sequence 5'-CC-3' and cleaves 5' to the first C. It cleaves 5'-C^{m}C-3' sequences but not 5'-^{m}CC-3' sequences. The enzyme creates breaks in dsDNA whenever two 5'-CC-3' sequences on opposite strands are close enough for the two strands to separate; when the 5'-CC-3' sequences on opposite strands are further apart only a portion of the strands separate. Consequently, NYs-1 endonuclease does not produce a completely stable DNA digestion pattern. The enzyme probably does not cleave ssDNA and definitely does not cleave ssRNA or dsRNA.

32201 Potential role of proteolysis in the control of UvrABC incision. Caron, P.R. (Johns Hopkins Univ. Baltimore, MD (USA)); Grossman, L. *Nucleic Acids Research (UK),* 16(20): 9641-9650 (25 Oct 1988). DOE Contract FG02-86ER60396.

UvrB is specifically proteolyzed in Escherichia coli cell extracts to UvrB*. UvrB* is capable of interacting with UvrA in an apparently similar manner to the UvrB, however UvrB* is defective in the DNA strand displacemen activity normally displayed by UvrAb. Whereas the binding of UvrC to a UvrAB-DNA complex leads to DNA incision and persistence of a stable post-incision protein-DNA complex, the binding of UvrC to UvrAB* leads to dissociation of the protein complex and no DNA incision is seen. The factor which stimulates this proteolysis has been partially purified and its substrate specificity has been examined. The protease factors is induced by stress and is under control of the htpR gene. The potential role of this proteolysis in the regulation of levels of active repair enzymes in the cell is discussed.

32202 Involvement of cryptic ATPase activity of UvrB and its proteolysis product, UvrB* in DNA repair. Caron, P.R. (John Hopkins Univ., Baltimore, MD (USA)); Grossman, L. *Nucleic Acids Research (UK),* 16(20): 9651-9662 (25 Oct 1988). DOE Contract FG02-86ER60396.

The incision of damaged DNA by the Escherichia coli UvrABC endonuclease requires ATP hydrolysis. Although the deduced sequence of the UvrB protein suggests a putative ATP binding site, no nucleoside triphosphatase activity is demonstrable with the purified UvrB protein. The UvrB protein is specifically proteolyzed in E. coli cell extracts to yield a 70 kD fragment, referred to as UvrB*, which has been purified and is shown to possess a single-strand DNA dependent ATPase activity. Substrate specificity and kinetic analyses of UvrB* catalyzed nucleotide hydrolysis indicate that the stimulation in DNA dependent ATPase activity following formation of the UvrAB complex results from the activation of the normally sequestered UvrB associated ATPase. Using nucleotide analogues, it can be shown that this activity is essential to the DNA incision reaction carried out by the UvrABC complex.

5504 Genetics

Refer also to citation(s) 32096, 32154, 32157, 32159, 32164

32203 Cold Spring Harbor symposia on quantitative biology: Volume 51, Molecular biology of Homo sapiens. 702p. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1986). Sponsored by DOE Energy Research. From 51. Cold Spring Harbor symposium on quantitative biology: molecular biology of Homo sapiens; Cold Spring Harbor, New York, USA; 28 May - 4 jun 1986.

Thirteen years marked the time between the discovery of the double helix in 1953 and the elucidation of the genetic code in 1966. A similar interval has now passed since the development by Cohen and Boyer of a simple procedure for the cloning of selective DNA fragments. The scientific advances made possible by the subsequent modification and elaboration of these original cloning procedures now amaze, stimulate, and increasingly often overwhelm us. Facts that until recently were virtually unobtainable now flow forth almost effortlessly. Most excitingly, the frenetic pace of these new discoveries, instead of marking the impending end of a glorious moment of learning, give every indication of opening up scientific frontiers that will take hundreds if not thousands of years to explore thoroughly. This new era of enlightenment is nowhere more apparent than in our newfound ability to study ourselves at the molecular level. This volume is the first of two collections of papers submitted by the contributors to the Cold Spring Harbor symposia on quantitative biology for 1986 - molecular biology of Homo sapiens. Contained in this collection are 80 papers grouped into sessions entitled Human Gene Map, Genetic Diagnosis, Human Evolution, and Drugs Made Off Human Genes.

32204 Genetic delineation of functional components of the group I intron in the phage T4 td gene. Belfort, M. (New York State Department of Health, Albany, NY (USA)); Chandry, P.S.; Pedersen-Lane, J. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

A genetic study to dissect the catalytic components of td pre-mRNA has been initiated, taking advantage of those phenotypes that reflect td function as well as td dysfunction. First, linker insertion and deletion mutants were generated to probe the role of the central intron elements in splicing and to provide a splicing-proficient deletion construct for subsequent point mutagenesis studies. Second, 13 nondirected splicing-defective mutants were isolated and characterized. These random chemically induced mutations, which were isolated strictly on the basis of phenotype, are scattered throughout the two functional domains of the intron. Although some mutations are in phylogenetically conserved elements previously shown to be of functional importance in fungal mitochondrial and Tetrahymena precursors (P1, P4, and P7), others are in elements to which no role is splicing has previously been ascribed (P5, P6, P7.2, P8, and P9.2). Relating these structural changes to aberrations in catalytic performance will provide a useful adjunct to functional studies of an RNA enzyme.

32205 Family of autocatalytic group I introns in bacteriophage T4. Shub, D.A. (State Univ. of New York, Albany (USA)); Xu, M.Q.; Gott, J.M.; Zeeh, A.; Wilson, L.D. pp. 8 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The discovery of an intron in phage T4 encouraged the authors to look for additional group I introns in the T4 genome. Further examples would permit sequence and structural comparisons that might lend insight into their evolutionary origin. Additionally, they hoped that their locations within the T4 genome would infer a possible regulatory function in prokaryotic gene expression. They took advantage of the fact that, since G is added to the 5' end of the intron, autocatalytic group I introns could be specifically labeled in vitro for use as probes for DNA blotting experiments. If Group I introns were in more than just the td gene, multiple RNA species should be labeled when total RNA is extracted from T4-infected cells and incubated with [α-^{32}P]GTP in vitro. When used as a probe for a Southern blot of T4 DNA, this RNA should hybridize to several DNA bands.

32206 Long-range intron-exon and intron-intron pairings involved in self-splicing of class II catalytic introns. Michel, F. (Laboratoire Associe a l'Universite Pierre et Marie Curie, Gif-sur-Yvette (France)); Jacquier, A. pp. 12 of Cold Spring Harbor symposia on quantitative biology. Volume 52, Evolution of catalytic function. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY (1987). From Cold Spring Harbor symposia on quantitative biology: evolution of catalytic function; Cold Spring Harbor, New York, USA; Jul 1987.

The authors have addressed the question of how mutual recognition of class II introns and their 5' exons is ensured. They now show that (1) it relies on multiple pairings between the introns and their 5' exons and (2) in a fraction of class II members, one of the intron-exon pairings could be extended by incorporating the first nucleotide or first few nucleotides of the 3' exon, just like in class I. In addition, they report that, on the intron side of the 3' exon-intron junction, the last intron nucleotide is involved in a solitary base pair, together with a nucleotide that is part of the intron's core, several

hundred residues further upstream. Some aspects of this work were dealt with previously but will be discussed again in a functional perspective.

32207 **Statistical mechanics of a nonlinear model for DNA denaturation.** Peyrard, M. (Laboratoire ORC, Faculte des Sciences, 6, boulevard Gabriel, 21100 Dijon, France(US)); Bishop, A. R. *Physical Review Letters (USA),* 62(23): 2755-2758 (5 Jun 1989).

We investigate the statistical mechanics of a simple lattice model for thedenaturation of the DNA double helix. The model consists of two chainsconnected by Morse potentials representing the H bonds. We determine thetemperature dependence of the interstrand separation and we show that amechanism involving an energy localization analogous to self-focusing mayinitiate the denaturation.

5505 Metabolism

Refer also to citation(s) 31507, 32135

32208 (GSF–14/88) **Investigation of the induction of oxidative DNA damage by means of an enzyme-linked immunosorbent assay (ELISA) for thymine glycol containing DNA.** Pohlenz-Michel, C. Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.); Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Toxikologie. 1988. 98p. (In German). Order Number DE89774745/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The report explains an ELISA test system for the detection and quantification of toxic effects on genes, induced by mutagenic or carcinogenic chemicals introduced by way of reactive oxygen species. Sensitivity and reproducibility are defined, and the system's applicability to the detection of oxidative DNA damage as a result of the metabolism of chemicals in cellular systems is discussed. (TRV).

32209 (INIS-mf–11953) **Experimental study on the usefulness of magnetotherapy in bone fractures (tibial osteotomy in the rat). Accumulation of 99 mTc MDP - tests of tensile strength - determination of alkaline phosphatase.** Sailer, R. Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin. 9 Jul 1985. 101p. (In German). Order Number DE89774609/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Non-directional magnetic field therapy using a flux density of 60 G and a frequency of 25 Hz was carried out over 12 hours daily in rats in order to ascertain its influence on the healing process following osteotomy of the tibia with internal splint fixation of the fractured bone being carried out as an additional measure. The results thus achieved were compared to those seen in control animals, were no magnetotherapy was carried out, on the basis of scintiscan studies using 99 mTc MDP (degree of density in the callus formed around the fracture zone), the plasma levels of alkaline phosphatase and tests of tensile strength. The follow-up observations of the healing process were additionally based on radiological and histological evaluations of the animals. Beneficial effects of magnetotherapy on the healing process could not be confirmed with any statistical significance. (TRV).

32210 (LBL–27196) **Following macromolecular interactions and sugar metabolism using site specific ^{3}H labelling and NMR spectroscopy.** Williams, P.; Morimoto, Hiromi; Gehring, K.B.; Nikaido, Hiroshi; Carson, P.; Un, Sun; Klein, M.; Wemmer, D.E. Lawrence Berkeley Lab., CA (USA). Jun 1988. 4p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-880787–6: 3. international symposium on the synthesis and applications of isotopically labeled compounds, Innsbruck, Austria, 17-21 Jul 1988). Order Number DE89013689/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In this paper we discuss the application of ^{3}H NMR to biological problems. Two specific examples will be described; first, analysis of the binding of maltose to its transport protein from E. coli, called MBP; and second, following the glycolytic metabolism of glucose in erythrocytes. In both of these cases the unique properties of ^{3}H for magnetic resonance make possible observations which are difficult with other methods. 4 refs., 2 figs.

5506 Medicine

Refer also to citation(s) 31574, 32360, 32382, 32388, 32762, 32763

32211 (CONF-8905121–1) **Identification of a non-specific inhibitor of [methyl^{3}H]thymidine incorporation into DNA of normal and pre-neoplastic cells.** Overbye, L.J. Oak Ridge National Lab., TN (USA). [1989]. 6p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From National conference of undergraduate research; San Antonio, Texas, USA; May 1989. Order Number DE89010372/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Growth in mammalian cells is controlled by a variety of factors, both stimulatory and inhibitory. Bullough et al. (2) first proposed the idea that endogenous mitotic inhibitors may play a role in controlling cellular proliferation. Inhibitors may be tissue-specific (9) or non-specific (for review see Lozzio et al. (5)). Although many inhibitors are proteins of high molecular weights, several low molecular weight inhibitors of [^{3}H] thymidine incorporation (and therefore DNA synthesis) have been identified (1,3,6). Unlabelled thymidine has also been noted to be inhibitory (4). This paper describes a non-specific, unstable inhibitor that is found in media conditioned by neoplastic epithelial cells and some normal fibroblasts and inhibits [^{3}H] thymidine incorporation into normal and pre-neoplastic cells. The inhibitory activity has not been isolated and could consists of more than one compound. 9 refs., 1 tab.

32212 (INIS-BR–1516) **Proceedings of the 2. Iberian-American Congress of Oncology.** Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil). 1988. 156p. (In Portuguese). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Abstracts of subjects in oncology are presented. Several aspects concerning the diagnosis and therapy of neoplams are studied. (M.A.C.).

32213 (INIS-BR–1516, pp. 63) **Radiology of medullar carcinoma of breast.** Sabate, J. (Centro Oncologico, Sevilla (Spain). Servico Radiologia); Virizuela, J.A.; Jimenez, A.; Lozano, A. Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil). 1988. (In Spanish). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). In *Proceedings of the 2. Iberian-American Congress of Oncology.* Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

CARCINOMAS/diagnosis; CARCINOMAS/mammary glands; BIOMEDICAL RADIOGRAPHY; CARCINOMAS; DIAGNOSIS; RADIOLOGY

32214 (INIS-BR–1516, pp. 64) **Radiology of lobular carcinoma of breast in situ.** Sabate, J. (Centro Oncologico, Sevilla (Spain). Servico Radiodiagnostico). Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil). 1988. (In Spanish). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). In *Proceedings of the 2. Iberian-American Congress of Oncology.* Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

CARCINOMAS/diagnosis; CARCINOMAS/mammary glands; BIOMEDICAL RADIOGRAPHY; CARCINOMAS; DIAGNOSIS; RADIOLOGY

32215 (INIS-BR–1516, pp. 79) **Echography in diagnosis of breast cancer.** Bellet, M.; Meunier, P.H.; Roriz, R. Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil). 1988. (In Portuguese). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). In *Proceedings of the 2. Iberian-American Congress of Oncology.* Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

NEOPLASMS/diagnosis; NEOPLASMS/mammary glands; IMAGES; NEOPLASMS; DIAGNOSIS; ULTRASONIC WAVES

32216 (INIS-BR–1516, pp. 6) **Whole-body irradiation at I.P.O.F.G., Lisboa: technic and dosimetry.** Assuncao Matos, H. de; Silva, J.G. da; Ponte, M.A. de. Sociedade Brasileira de

Cancerologia, Salvador, BA (Brazil). 1988. (In Portuguese). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). In *Proceedings of the 2. Iberian-American Congress of Oncology*. Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

WHOLE-BODY IRRADIATION/dosimetry; WHOLE-BODY IRRADIATION/radiotherapy; BONE MARROW; COMPARATIVE EVALUATIONS; PHANTOMS; RADIATION DOSES; TRANSPLANTS; DOSIMETRY; RADIOTHERAPY

32217 (INIS-BR–1516, pp. 30) **Bone marrow transplantation at Inst. Port. Oncologia - Lisbon (Portugal).** Abecasis, M.M.; Nolasco, I. and others. Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil). 1988. (In Portuguese). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). In *Proceedings of the 2. Iberian-American Congress of Oncology*. Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

BONE MARROW/transplants; TRANSPLANTS; CHEMOTHERAPY; IMMUNOSUPPRESSION; RADIOTHERAPY

32218 (INIS-BR–1516, pp. 23) **Efficacy of alfa-interferon as coadjuvant therapy of melanoma stage II.** Robinson, W.A.; Gonzalez, R.; Adlakha, A.; Lamb, R.; Rovira, D.; Ferguson, J. Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil). 1988. (In Spanish). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). In *Proceedings of the 2. Iberian-American Congress of Oncology*. Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

INTERFERON/melanomas; INTERFERON; MELANOMAS; RADIOTHERAPY; SURGERY

32219 (INIS-BR–1516, pp. 109) **Primary radiotherapy x mastectomy in operable cancrum of breast.** Trindade, M.C. (Instituto Portugues de Oncologia, Lisbon); Roldao, M.; Brites, C.F. Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil). 1988. (In Portuguese). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). In *Proceedings of the 2. Iberian-American Congress of Oncology*. Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

NEOPLASMS/mammary glands; COBALT 60; COMPARATIVE EVALUATIONS; NEOPLASMS; RADIOTHERAPY; SURGERY

32220 (INIS-BR–1516, pp. 116) **Cancer of endometrium, stage I. Treatment and results.** Ianzos, E.; Ramos, A. and others. Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil). 1988. (In Spanish). (CONF-8810366–: 2. Iberian-American congress of oncology, Salvador, Brazil, 9-14 Oct 1988). In *Proceedings of the 2. Iberian-American Congress of Oncology*. Order Number DE89613927/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

NEOPLASMS/radiotherapy; NEOPLASMS/uterus; EXTERNAL IRRADIATION; INTERNAL IRRADIATION; NEOPLASMS; RADIOTHERAPY; UTERUS

32221 (INIS-mf–11404 S3) **MR diagnosis of the liver - state and prospect.** Hamm, B. (Freie Univ. Berlin (Germany, F.R.). Klinikum Steglitz). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LIVER/nmr imaging; COMPARATIVE EVALUATIONS; COMPUTERIZED TOMOGRAPHY; CONTRAST MEDIA; DTPA; GADOLINIUM COMPLEXES; LIVER; PARAMAGNETISM; SENSITIVITY

32222 (INIS-mf–11404 S4) **Comparison of imaging procedures in the diagnosis of expanding processes of the liver.** Luening, M. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Wolff, H.; Simon, C.; Buchali, K.; Schoepke, W.; Decker, T.; Sandring, K.H.; Muehler, A.; Koch, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

DIAGNOSIS/comparative evaluations; LIVER/diagnosis; BIOMEDICAL RADIOGRAPHY; COMPUTERIZED TOMOGRAPHY; DIAGNOSIS; LIVER; NEOPLASMS; NMR IMAGING; SCINTISCANNING; ULTRASONOGRAPHY

32223 (INIS-mf–11404 S5) **Differential diagnosis of focal hepatic lesions by MR.** Stark, D.D. (Massachusetts General Hospital, Boston (USA)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LIVER/nmr imaging; ACCURACY; ANGIOMAS; CARCINOMAS; LIVER; METASTASES; PATIENTS

32224 (INIS-mf–11404 S7) **Multilayered gradient echo sequence in MRT of focal hepatic lesions.** Sander, B. (Freie Univ. Berlin (Germany, F.R.)); Bittner, R.; Laniado, M.; Langer, M.; Claussen, C.; Felix, R. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LIVER/nmr imaging; LIVER; NEOPLASMS; PATIENTS; TOMOGRAPHY

32225 (INIS-mf–11404 S8) **Quantitative evaluation of dynamic computed tomograms in liver cirrhosis.** Rosenkranz, G. (3932850DD); Tellkamp, H.; Kobe, E. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LIVER CIRRHOSIS/computerized tomography; PATIENTS

32226 (INIS-mf–11404 S10) **Importance of CT and MR in extracorporeal cholelithotripsy.** Golder, W. (Technische Univ. Muenchen (Germany, F.R.)); Tempel, K. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BILIARY TRACT/calculi; CALCULI/computerized tomography; CALCULI/nmr imaging; CALCULI; CALCIUM COMPOUNDS; DENSITOMETERS; IN VITRO; IN VIVO; QUALITATIVE CHEMICAL ANALYSIS; THERAPY

32227 (INIS-mf–11404 S11) **CT-cholegraphy.** Hegedues, V. (Copenhagen Univ. (Denmark)); Herss Nielsen, V.A.; Sletting, S. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BILIARY TRACT/computerized tomography; BILIRUBIN; BIOMEDICAL RADIOGRAPHY; COMPARATIVE EVALUATIONS; CONTRAST MEDIA; DIGESTIVE SYSTEM DISEASES; LIVER; PANCREAS; PATIENTS; ULTRASONOGRAPHY

32228 (INIS-mf–11404 S16) **Fast-scan magnetic resonance imaging.** Haase, A. (Max-Planck-Institut fuer Biophysikalische Chemie (Karl-Friedrich-Bonhoefer-Inst.), Goettingen (Germany, F.R.)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German

Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/optimization; OPTIMIZATION; SPATIAL RESOLUTION; TIME DEPENDENCE

32229 (INIS-mf–11404 S17) **Medical applications of field cycling relaxometry.** Rinck, P. (Trondheim Univ. (Norway)); Fischer, H.W.; Muller, R.N. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/relaxation time; MAGNETIC FIELDS; OPTIMIZATION

32230 (INIS-mf–11404 S18) **Theoretical evaluation and experimental results of parameter weighting in NMR imaging.** Schmidt, D. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Schnackenburg, B.; Timm, G.; Dewey, C. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/weighting functions

32231 (INIS-mf–11404 S19) **Test of NMR image quality affecting parameters.** Juran, R. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Schnackenburg, B.; Schmidt, D.; Timm, G. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/quality assurance; RELAXATION TIME; SIGNAL-TO-NOISE RATIO; SPATIAL RESOLUTION

32232 (INIS-mf–11404 S21) **Trends in development of computerized tomography and future applicability.** Gursky, S. (3526512DD); Lieberenz, S. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/uses; USES; IMAGE PROCESSING; MEMORY DEVICES; PERFORMANCE; PLANNING; RADIOTHERAPY; SURGERY

32233 (INIS-mf–11404 S22) **Take-over of CT images by Robotron computer from Tomoscan CX.** Tabbert, E. (Bezirkskrankenhaus, Schwerin (German Democratic Republic)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/computers; COMPUTERS; IMAGE PROCESSING; MAGNETIC DISKS; MAGNETIC TAPES

32234 (INIS-mf–11404 S23) **Gd-DTPA - a positive oral contrast medium in abdominal MR tomography.** Kaminsky, S. (Klinikum Rudolf Virchow, Berlin-Charlottenburg (Germany, F.R.). Radiologische Klinik und Poliklinik); Laniado, M.; Kornmesser, W.; Claussen, C.D.; Felix, R. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ABDOMEN/nmr imaging; NMR IMAGING/contrast media; ABDOMEN; DTPA; GADOLINIUM COMPLEXES; INTESTINES; KIDNEYS; LIVER; ORAL ADMINISTRATION; PANCREAS; SPLEEN

32235 (INIS-mf–11404 S24) **Quality control in computerized tomography.** Rockstroh, G. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung); Lieberenz, S.; Straubel, U. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/quality control; IMAGES; RADIATION DOSES

32236 (INIS-mf–11404 S25) **Reduction of artefacts in CT diagnosis caused by metallic implants.** Felsenberg, D. (Freie Univ. Berlin (Germany, F.R.). Klinikum Steglitz); Sokiranski, R.; Fobbe, F.; Koch, H.C.; Ebersberger, J.; Kalender, W.A. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/image processing; IMPLANTS; MEDICAL SUPPLIES; METALS; OPTIMIZATION; PROSTHESES

32237 (INIS-mf–11404 S27) **CT and MRI of the brain.** Zimmermann, R.A. (Pennsylvania Univ., Philadelphia (USA)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; BRAIN/nmr imaging; BRAIN; HEMOSIDERIN; ISCHEMIA; NEOPLASMS; SENSITIVITY; SPECIFICITY

32238 (INIS-mf–11404 S28) **Grading of brain tumors by computer-aided analysis of CT images and by anamnestic data.** Michalik, M. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Michalik, S.; Ziegengeist, S.; Wolf, M.; Harms, L.; Meffert, B.; Planitzer, J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/image processing; BRAIN; NEOPLASMS; PATIENTS

32239 (INIS-mf–11404 S29) **NMR imaging of intracranial tumors in children as compared with CT.** Baierl, P. (Muenchen Univ. (Germany, F.R.). Klinik und Poliklinik fuer Radiologie); Bauer, W.M.; Muehlsteffen, A.; Fink, U.; Foerster, C. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; BRAIN/nmr imaging; ADOLESCENTS; BRAIN; CHILDREN; COMPARATIVE EVALUATIONS; CONTRAST MEDIA; INFANTS; NEOPLASMS; PATIENTS; SENSITIVITY; SPECIFICITY

32240 (INIS-mf–11404 S30) **Indication and accuracy of CT-aided biopsy of the brain.** Schulz, W. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Harms, L.; Jaenisch, W.; Reichmuth, B. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct

1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOPSY/computerized tomography; ACCURACY; BIOPSY; BRAIN; NEOPLASMS; NMR IMAGING

32241 (INIS-mf–11404 S31) **CT-aided punctures in cerebral and spinal cystic processes.** Molsen, H.P. (Staedtisches Klinikum, Berlin-Buch (German Democratic Republic)); Siedschlag, W.D.; Winkelmann, H. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CYSTS/computerized tomography; BRAIN; CYSTS; SPINAL CORD

32242 (INIS-mf–11404 S32) **CT-aided specimen collection - an alternative to stereotaxic cerebral biopsy.** Zur, C. (Militaermedizinische Akademie, Bad Saarow (German Democratic Republic)); Steffen, H.; Luttschwager, L.; Scheibler, C. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; BIOPSY; BRAIN

32243 (INIS-mf–11404 S33) **Differential diagnosis of white substance alterations by NMR imaging.** Rinck, P. (Trondheim Univ. (Norway)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/nmr imaging; BRAIN; NERVOUS SYSTEM DISEASES

32244 (INIS-mf–11404 S34) **Native and contrast medium NMR imaging of meningeal diseases.** Schoerner, W. (Freie Univ. Berlin (Germany, F.R.)); Henkes, H.; Sander, B.; Felix, R. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MENINGES/nmr imaging; CONTRAST MEDIA; DTPA; GADOLINIUM COMPLEXES; MENINGES; NERVOUS SYSTEM DISEASES

32245 (INIS-mf–11404 S35) **Computed tomography of the brain after posttraumatic changes.** Genov, H. (Department of Radiology-High Medical Institute, Plovdiv (Bulgaria)); Dimitrov, Z. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; BRAIN; HEAD; INJURIES

32246 (INIS-mf–11404 S36) **Age dependence of subarachnoid spaces as evidenced by CT.** Tellkamp, H. (Medizinische Akademie, Dresden (German Democratic Republic)); Rosenkranz, G.; Dahl, K.; Koehler, K. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; AGE DEPENDENCE; ATROPHY; BRAIN

32247 (INIS-mf–11404 S37) **Changes of the cerebral computed tomogram in children during cytostatic therapy.** Tellkamp, H. (Medizinische Akademie, Dresden (German Democratic Republic). Radiologische Klinik); Koehler, K.; Lauterbach, I. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; LEUKEMIA/antimitotic drugs; BRAIN; CHEMOTHERAPY; CHILDREN; LEUKEMIA; PATIENTS

32248 (INIS-mf–11404 S39) **Diagnostic value of NMR imaging in myopathies.** Zschenderlein, R. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Planitzer, J.; Dewey, C. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MUSCLES/nmr imaging; MUSCLES/pathological changes; BIOPSY; COMPARATIVE EVALUATIONS; COMPUTERIZED TOMOGRAPHY; MUSCLES

32249 (INIS-mf–11404 S40) **Tissue discrimination - advances in CT and MRI.** Isherwood, I. (Manchester Univ. (UK)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

TISSUES/computerized tomography; TISSUES/nmr imaging; BLOOD FLOW; BRAIN; CHEMICAL SHIFT; CONTRAST MEDIA; DIFFUSION; DTPA; GADOLINIUM COMPLEXES; MAGNETIC SUSCEPTIBILITY; MAGNETITE; PARAMAGNETISM; PROTON DENSITY; RELAXATION TIME; SUPERPARAMAGNETISM; TISSUES

32250 (INIS-mf–11404 S41) **Role of the MRI in medical imaging - socio-economical analyses.** Collard, M. (Universite Libre de Bruxelles (Belgium)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/socio-economic factors; COST BENEFIT ANALYSIS; ECONOMICS

32251 (INIS-mf–11404 S42) **CT system Tomoscan in clinical diagnostics as experienced in ten-month application.** Bogun, K.R. (Bezirkskrankenhaus, Schwerin (German Democratic Republic)); Goltermann, J.; Zellerhoff, W. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/uses; AVAILABILITY; CAPACITY; USES; EFFICIENCY; IMAGES; PERFORMANCE; RELIABILITY

32252 (INIS-mf–11404 S43) **MRT and CT of the esophageal cancer.** Roemer, T. (Freie Univ. Berlin (Germany, F.R.). Klinikum Steglitz); Nauert, T.; Wolf, K.J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CARCINOMAS/computerized tomography; CARCINOMAS/nmr imaging; ESOPHAGUS/carcinomas; CARCINOMAS; CONTRAST MEDIA; DTPA; ESOPHAGUS; GADOLINIUM COMPLEXES; PATIENTS

32253 (INIS-mf–11404 S44) **Contribution of computerized tomography to estimating severity of acute pancreatitis.** Kursawe, R. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Luening, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

DIGESTIVE SYSTEM DISEASES/computerized tomography; PANCREAS/digestive system diseases; ABSCESSES; COMPARATIVE EVALUATIONS; EDEMA; HEMORRHAGE; NECROSIS; PANCREAS; PATIENTS; SURGERY

32254 (INIS-mf–11404 S45) **Findings in diabetics examined by computed tomography.** Brunova, J. (Karlova Univ., Prague (Czechoslovakia)); Bruna, J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

DIABETES MELLITUS/computerized tomography; BLOOD VESSELS; INSULIN; KIDNEYS; LIVER; PANCREAS; PATIENTS; SPLEEN

32255 (INIS-mf–11404 S46) **Computed tomography of splenic trauma.** Srp, A. (Radiologicka Klinika, Prague (Czechoslovakia)); Bruna, J.; Halman, L. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SPLEEN/computerized tomography; SPLEEN/injuries; KIDNEYS; LIVER; PATIENTS; SPLEEN; INJURIES

32256 (INIS-mf–11404 S47) **CT diagnosis of rectal tumors.** Freitag, J. (Medizinische Akademie, Magdeburg (German Democratic Republic)); Rosenkranz, M.; Freitag, G.; Baethge, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RECTUM/carcinomas; RECTUM/computerized tomography; LIVER; LYMPH NODES; METASTASES; PATIENTS; RECTUM; CARCINOMAS

32257 (INIS-mf–11404 S48) **MRT in endocrine orbitopathia.** Hosten, N. (Freie Univ. Berlin (Germany, F.R.)); Cordes, M.; Schoerner, W.; Felix, R. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

EYES/endocrine diseases; EYES/nmr imaging; COMPUTERIZED TOMOGRAPHY; EDEMA; EYES; PATIENTS; SKULL

32258 (INIS-mf–11404 S49) **CT in different types of tumors of the nasopharynx and of the paranasal sinuses.** Marciniak, R. (Akademia Medyczna, Wroclaw (Poland)); Wasik, A. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

PHARYNX/computerized tomography; CONTRAST MEDIA; NEOPLASMS; NOSE; PATIENTS; PHARYNX; SKULL

32259 (INIS-mf–11404 S52) **Integrated MRI/MRS.** Kressel, H.Y. (Pennsylvania Univ., Philadelphia (USA). Dept. of Radiology); Lenkinski, R.E. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/nmr spectra; CHEMICAL SHIFT; SPECTROSCOPY

32260 (INIS-mf–11404 S53) **Current status of in vivo NMR spectroscopy in medicine.** Hajek, M. (Institute for Clinical and Experimental Medicine, Prague (Czechoslovakia)); Vavrinkova, H.; Teplan, V.; Belan, A. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MAN/nmr spectra; BIOLOGICAL MODELS; BRAIN; CARBON 13; FLUORINE 19; HEART; HYDROGEN 1; ISCHEMIA; LIVER; MAN; METABOLISM; MUSCLES; PATIENTS; PHOSPHORUS 31; SPECTROSCOPY; UREMIA

32261 (INIS-mf–11404 S54) **/sup 1/H-NMR spectroscopy - a new method in tumor diagnosis?.** Hentschel, M. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Krebsforschung); Merkle, K.; Findeisen, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NEOPLASMS/nmr spectra; BLOOD PLASMA; CELL MEMBRANES; DIAGNOSIS; HYDROGEN 1; LIPIDS; LIPOPROTEINS; NEOPLASMS; SPECIFICITY; SPECTROSCOPY; TUMOR CELLS

32262 (INIS-mf–11404 S55) **Optimization of pulse sequence and parameters in NMR imaging to improve the contrast-to-noise ratio by non-linear optimization.** Schneider, W. (Akademie der Wissenschaften der DDR, Berlin. Zentrum fuer wissenschaftlichen Geraetebau); Dreher, W.; Boernert, P. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/optimization; CONTRAST MEDIA; IMAGE PROCESSING; OPTIMIZATION; NOISE

32263 (INIS-mf–11404 S56) **Nuclear magnetic relaxometry: a technique complementary to imaging and spectroscopy.** Muller, R.N. (Mons Univ. (Belgium)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NUCLEAR MAGNETIC RESONANCE/relaxation; NUCLEAR MAGNETIC RESONANCE/spectroscopy; NMR IMAGING; NMR SPECTRA; RELAXATION; SPECTROSCOPY

32264 (INIS-mf–11404 S57) **Methodology and first clinical application of localized proton spectroscopy in cases of brain tumors and ischemic insults.** Bruhn, H. (Siemens A.G., Erlangen (Germany, F.R.). Unternehmensbereich Medizinische Technik); Frahm, J.; Gyngell, M.L.; Merboldt, K.D.; Haenicke, W.; Sauter, R. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/proton spectra; NMR IMAGING/spectroscopy; BRAIN; ISCHEMIA; NEOPLASMS; SPECTROSCOPY; PATIENTS; SIGNAL-TO-NOISE RATIO

32265 (INIS-mf–11404 S58) **Experience with /sup 15/N-NMR spectroscopy in animal experiments.** Buchali, K. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Gruender, W.; Krumbiegel, P.; Keller, T.; Blesin, H.J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LIVER/nmr spectra; RATS/nitrogen 15; COMPARATIVE EVALUATIONS; EMISSION SPECTROSCOPY; GLYCINE; LIVER; RATS; SENSITIVITY

32266 (INIS-mf–11404 S59) **Influence of pentoxifylline on recovery of rat ischemic kidneys as evidenced by /sup 31/P-NMR spectroscopy.** Ellermann, J. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Gruender, W.; Keller, T. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ISCHEMIA/nmr spectra; KIDNEYS/ischemia; BIOLOGICAL RECOVERY; ISCHEMIA; KIDNEYS; PHOSPHORUS 31; RATS; SPECTROSCOPY; VASODILATORS

32267 (INIS-mf–11404 S60) **Studies of cardiac protection by anti-ischemic and cytoprotective drugs, resp., using /sup 31/P-NMR spectroscopy.** Keller, T. (3526506DD); Gruender, W.; Pissarek, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MYOCARDIUM/nmr spectra; ISCHEMIA; LABORATORY ANIMALS; MYOCARDIUM; PERFUSED ORGANS; PHOSPHORUS 31; PROSTAGLANDINS; RADICALS; SCAVENGING; SPECTROSCOPY

32268 (INIS-mf–11404 S61) **Exercise-induced changes of the articular cartilage diagnosed by /sup 1/H-NMR relaxation spectroscopy.** Dannhauer, K.H. (3526506DD); Gruender, W.; Keller, T.; Arnold, K. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CARTILAGE/exercise; CARTILAGE/nmr spectra; BONE JOINTS; CARTILAGE; EXERCISE; HYDROGEN 1; IN VITRO; JAW; RELAXATION; SPECTROSCOPY

32269 (INIS-mf–11404 S62) **Effect of substances shortening the relaxation time on /sup 31/P and /sup 13/C-NMR spectroscopy.** Gewiese, B. (Freie Univ. Berlin (Germany, F.R.). Klinikum Steglitz); Roemer, T.; Stiller, D.; Wolf, K.J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LIVER/nmr spectra; NMR SPECTRA/magnetite; PHANTOMS/nmr spectra; CARBON 13; LIVER; MAGNETITE; PERFUSED ORGANS; PHANTOMS; PHOSPHORUS 31; RATS; RELAXATION TIME; SPECTROSCOPY

32270 (INIS-mf–11404 S63) **NMR spectroscopy of the perfused rat liver: technical considerations.** Stiller, D. (Freie Univ. Berlin (Germany, F.R.). Klinikum Steglitz); Gewiese, B.; Roemer, T.; Wolf, K.J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

PERFUSED ORGANS/nmr spectra; RATS/liver; RATS; LIVER; SPECTROSCOPY

32271 (INIS-mf–11404 S64) **Effectivity of perfusion solutions for kidney preservation assessed by means of /sup 31/P-NMR spectroscopy.** Gruender, W. (3526504DD); Wesslau, C.; Keller, T.; Jung, K.; Scholz, D. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

KIDNEYS/grafts; SOLUTIONS/nmr spectra; IN VITRO; IN VIVO; KIDNEYS; GRAFTS; PERFUSED ORGANS; PHOSPHORUS 31; PRESERVATION; RATS; SOLUTIONS; SPECTROSCOPY

32272 (INIS-mf–11404 S67) **Digital radiography today - state of the art.** Bach, E.F. (Siemens A.G., Erlangen (Germany, F.R.). Unternehmensbereich Medizinische Technik). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOMEDICAL RADIOGRAPHY/digital systems; IMAGE PROCESSING

32273 (INIS-mf–11404 S69) **MRI contrast agents.** Stark, D.D. (Boston City Hospital, MA (USA)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

NMR IMAGING/contrast media; DTPA; FERRITES; GADOLINIUM COMPLEXES; NOISE; RELAXATION TIME; TOXICITY

32274 (INIS-mf–11404 S70) **Nephrotoxicity of high doses of contrast media in humans.** Moreau, J.F. (Hopital Boucicaut, Paris (France)); Souissi, M.; Chabriais, J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CONTRAST MEDIA/organic iodine compounds; KIDNEYS/toxicity; KIDNEYS; TOXICITY; PATIENTS; UROGENITAL SYSTEM DISEASES

32275 (INIS-mf–11404 S71) **Gd-DTPA in hypophyseal microadenoma diagnosis.** Planitzer, J. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Dewey, C.; Pfueller, B.; Luening, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ADENOMAS/pituitary gland; NMR IMAGING/contrast media; ADENOMAS; COMPUTERIZED TOMOGRAPHY; CUSHING SYNDROME; DTPA; GADOLINIUM COMPLEXES; PATIENTS; WOMEN

32276 (INIS-mf–11404 S72) **Dynamic MRI of transplanted kidneys after application of Gd-DTPA.** Dewey, C. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Schnackenburg, B.; Koch, M.; Scholz, D.; Luening, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

KIDNEYS/grafts; NMR IMAGING/contrast media; DTPA; GADOLINIUM COMPLEXES; KIDNEYS; GRAFTS; PATIENTS

32277 (INIS-mf–11404 S73) **Angiography of hemodialysis access devices with low osmolality contrast media, technique and results.** Menanteau, B.P. (Reims Univ., 51 (France)); Treutenaere, J.M.; Marcus, C.; Ladam, V.; Gausserand, F. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOMEDICAL RADIOGRAPHY/contrast media; BLOOD VESSELS/biomedical radiography; BLOOD; DIALYSIS

32278 (INIS-mf–11404 S75) **NMR imaging in carditis and cardiomyopathies.** Sandring, K.H. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Foerster, A.; Lange, T.; Meyer, R.; Luening, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CARDIOVASCULAR DISEASES/nmr imaging; BIOPSY; COMPARATIVE EVALUATIONS; MYOCARDIUM; PATIENTS

32279 (INIS-mf–11404 S76) **Results of NMR imaging in post-surgical follow-up of heart transplantation patients.** Rienmueller, R. (Muenchen Univ. (Germany, F.R.)); Kemkes, B.M.; Erdmann, E.; Hacker, H.; Tiling, R.; Lloret, J.L. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

HEART/grafts; HEART/nmr imaging; CARDIOVASCULAR DISEASES; COMPARATIVE EVALUATIONS; HEART; GRAFTS; MAN; MYOCARDIUM; PATIENTS; SURGERY

32280 (INIS-mf–11404 S77) **NMR imaging of thoracic aortic dissection.** Spielmann, R.P. (Radiologische Klinik des UKE, Hamburg (Germany, F.R.)); Triebel, H.J.; Maas, R.; Buecheler, E. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

AORTA/nmr imaging; AORTA/ruptures; AORTA; RUPTURES; MEDIASTINUM; PATIENTS

32281 (INIS-mf–11404 S78) **Contrast-to-noise rate in ECG-triggered fast-field echo sequence.** Sandring, K.H. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Sommer, L.; Luening, M.; Mueller, C. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

HEART/nmr imaging; ELECTROCARDIOGRAMS; HEART; NOISE; SPIN ECHO

32282 (INIS-mf–11404 S79) **MR diagnosis in vascular diseases.** Lizler, J. (Inst. for Clinical and Experimental Medicine, Prague (Czechoslovakia)); Filipova, H.; Tintera, J.; Belan, A. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CARDIOVASCULAR DISEASES/nmr imaging; AORTA; ARTERIES; BLOOD CIRCULATION

32283 (INIS-mf–11404 S81) **CT and MRI in the evaluation of bronchogenic carcinoma.** Sagel, S.S. (Mallinckrodt Inst. of Radiology, St. Louis, MO (USA)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRONCHI/computerized tomography; BRONCHI/nmr imaging; CARCINOMAS/bronchi; BRONCHI; CARCINOMAS

32284 (INIS-mf–11404 S82) **Conventional and fast NMR imaging in expanding processes of the thorax.** Bittner, R. (Freie Univ. Berlin (Germany, F.R.)); Duda, S.; Hosten, N.; Sander, B.; Claussen, C.; Weiss, T.; Felix, R.; Loddenkemper, R.; Kaiser, D. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CHEST/nmr imaging; CHEST; NEOPLASMS; PATIENTS

32285 (INIS-mf–11404 S84) **Possible evaluation of the dignity of pulmonary coin lesions by quantitative CT.** Bickhardt, J. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Luening, M.; Hieckel, H.G. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LUNGS/computerized tomography; LUNGS/pathological changes; LUNGS

32286 (INIS-mf–11404 S85) **N classification in preoperative staging of bronchial cancer by means of CT.** Hieckel, H.G. (Forschungsinstitut fuer Lungenkrankheiten und Tuberkulose, Berlin-Buch (German Democratic Republic)); Schmidt, M.; Schmidt, G. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CARCINOMAS/bronchi; CARCINOMAS/computerized tomography; CARCINOMAS; BRONCHI; LYMPH NODES; METASTASES; PATIENTS

32287 (INIS-mf–11404 S86) **Detection of isolated bronchoceles by CT.** Cobet, H. (Akademie der Wissenschaften der DDR, Berlin, Zentralinstitut fuer Herz-Kreislauf-Forschung); Schroeder, G.; Richter, K. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRONCHI/computerized tomography; BRONCHI/pathological changes; BRONCHI; EMPHYSEMA; PATIENTS

32288 (INIS-mf–11404 S87) **Thoracical high-resolution CT in pulmonary sarcoidosis.** Triebel, H.J. (Hamburg Univ. (Germany, F.R.). Radiologische Klinik und Strahleninstitut); Oesterreich, F.U.; Kanzow, G.; Heller, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

LUNGS/computerized tomography; LUNGS/respiratory system diseases; LUNGS; PATIENTS

32289 (INIS-mf–11404 S88) **Diagnosis of pulmonary embolism using CT.** Chudacek, Z. (Radiodiagnostische Universitaetsklinik, Plzen (Czechoslovakia)). Humboldt-Universitaet, Berlin

(German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
LUNGS/computerized tomography; LUNGS/emboli; LUNGS; EMBOLI; PATIENTS

32290 (INIS-mf--11404 S89) **CT and MRI of kidney, adrenal and abdominal lymph nodes.** Sagel, S.S. (Mallinckrodt Inst. of Radiology, St. Louis, MO (USA)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
ADRENAL GLANDS/computerized tomography; ADRENAL GLANDS/nmr imaging; KIDNEYS/computerized tomography; KIDNEYS/nmr imaging; LYMPH NODES/computerized tomography; LYMPH NODES/nmr imaging; ABDOMEN; BLOOD VESSELS; KIDNEYS

32291 (INIS-mf--11404 S91) **Some peculiar facts of the CT diagnosis of xanthogranulomatous pyelonephritis.** Georgescu, S.A. (Clinical Hospital Fundeni, Bucharest (Romania)); Lucan, M.; Popovici, D. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
NEPHRITIS/computerized tomography; EMPHYSEMA; GRANULOMAS; NEPHRITIS; PATIENTS

32292 (INIS-mf--11404 S93) **Comparison between MRI of transplanted kidneys and histological results.** Dewey, C. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Ditscherlein, W.; Scholz, D.; Luening, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
KIDNEYS/grafts; KIDNEYS/nmr imaging; BIOPSY; COMPARATIVE EVALUATIONS; HISTOLOGICAL TECHNIQUES; KIDNEYS; GRAFTS; PATIENTS

32293 (INIS-mf--11404 S94) **Computed tomography and MRI of the female pelvis.** Lamarque, J.L. (Hopital Saint Elvi, Montpellier (France)); Puiffoulloux, C.; Pujol, J.; Rouanet, J.P.; Salicru, B. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
PELVIS/computerized tomography; PELVIS/nmr imaging; WOMEN/pelvis; COMPARATIVE EVALUATIONS; PATIENTS; PELVIS; ULTRASONOGRAPHY; UROGENITAL SYSTEM DISEASES; WOMEN

32294 (INIS-mf--11404 S95) **Staging of prostatic cancer by NMR imaging.** Cramer, B.M. (Klinikum Barmen, Wuppertal (Germany, F.R.). Radiologische und Urologische Klinik); Schlegel, E.; Thueroff, J.W. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
PROSTATE/carcinomas; PROSTATE/nmr imaging; ADENOMAS; LYMPH NODES; PROSTATE; CARCINOMAS

32295 (INIS-mf--11404 S96) **Magnetic resonance imaging in recurrent carcinoma of the pelvis and its differentation from fibrosis.** Kressel, H.Y. (Pennsylvania Univ., Philadelphia (USA). Dept. of Radiology); Ebner, F.; Blum, L. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
PELVIS/nmr imaging; CARCINOMAS; FEMALE GENITALS; FIBROSIS; LARGE INTESTINE; PATIENTS; PELVIS; RELAXATION TIME

32296 (INIS-mf--11404 S99) **Comparison of CT and lymphography in staging primary malignant lymphomas.** Buhtz, C.; Freitag, J.; Franke, A.; Nielebock, E. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
LYMPHOMAS/biomedical radiography; LYMPHOMAS/computerized tomography; COMPARATIVE EVALUATIONS; LYMPH NODES; LYMPHOMAS; PATIENTS

32297 (INIS-mf--11404 S100) **Diagnosis of abdominal lymphomas by CT.** Bem, Z. (Akademia Medyczna, Wroclaw (Poland)); Marciniak, R. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
LYMPHOMAS/computerized tomography; ABDOMEN; LYMPHOMAS; PATIENTS

32298 (INIS-mf--11404 S101) **NMR imaging and CT of the spinal canal.** Claussen, C. (Klinikum Rudolf Virchow, Berlin-Charlottenburg (Germany, F.R.)); Treisch, J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
SPINAL CORD/computerized tomography; SPINAL CORD/nmr imaging; CONTRAST MEDIA; DTPA; GADOLINIUM COMPLEXES; VERTEBRAE

32299 (INIS-mf--11404 S102) **Differential diagnosis of intraspinal tumors by MRT.** Lehmann, R. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Planitzer, J.; Michalik, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
SPINAL CORD/neoplasms; SPINAL CORD/nmr imaging; NEOPLASMS

32300 (INIS-mf--11404 S103) **MRI of spinal AV-malformations.** Terwey, B. (Radiologische Gemeinschaftspraxis, Oldenburg (Germany, F.R.)); Vahldiek, G.; Becker, H.; Thron, A.K. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355--: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.
SPINAL CORD/malformations; SPINAL CORD/nmr imaging; CONTRAST MEDIA; DTPA; GADOLINIUM COMPLEXES; PATIENTS; MALFORMATIONS

32301 (INIS-mf--11404 S104) **Pre- and postoperative MRT findings in syringohydromyelia.** Harms, L. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Lehmann, R.; Planitzer, J.; Schulz, W. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355--: Charite-symposium 'CT and MR in

medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SPINAL CORD/malformations; SPINAL CORD/nmr imaging; PATIENTS; MALFORMATIONS; SURGERY

32302 (INIS-mf–11404 S105) **CT in diastematomyelia and diplomyelia.** Kusmiderski, J. (Akademia Medyczna, Krakow (Poland)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SPINAL CORD/computerized tomography; SPINAL CORD/malformations; CHILDREN; PATIENTS; MALFORMATIONS

32303 (INIS-mf–11404 S106) **MRT versus CT in tumors of skull base and lower brain stem.** Planitzer, M. (Zentralklinik fuer Neurologie und Psychiatrie, Berlin (German Democratic Republic)); Michalik, M.; Planitzer, J.; Vogel, S. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; BRAIN/nmr imaging; SKULL/computerized tomography; SKULL/nmr imaging; BRAIN; NEOPLASMS; PATIENTS; SKULL

32304 (INIS-mf–11404 S107) **CT-controlled lumbar sympathectomy in treatment of occlusive arterial disease.** Seibel, R.M. (Krankenhausinstitut, Muelheim an der Ruhr (Germany, F.R.)); Balzer, K.; Groenemeyer, D.H. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

AUTONOMIC NERVOUS SYSTEM/computerized tomography; AUTONOMIC NERVOUS SYSTEM/surgery; ARTERIOSCLEROSIS; SURGERY; PATIENTS

32305 (INIS-mf–11404 S108) **Abdominal sympathetic tumours complex CT diagnosis.** Roithova, Z. (Karlova Univ., Prague (Czechoslovakia). Lekarska Fakulta); Stenhova, H. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

AUTONOMIC NERVOUS SYSTEM/computerized tomography; AUTONOMIC NERVOUS SYSTEM/neoplasms; ABDOMEN; NEOPLASMS; CHILDREN; PATIENTS

32306 (INIS-mf–11404 S109) **Computer tomography of the backbone in the radicular lumbosacral syndrome.** Bruna, J. (Karlova Univ., Prague (Czechoslovakia). Lekarska Fakulta). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

VERTEBRAE/computerized tomography; VERTEBRAE/skeletal diseases; PATIENTS; SPONDYLITIS; VERTEBRAE

32307 (INIS-mf–11404 S110) **CT diagnosis of lumbar prolapse of an intervertebral disc.** Assmann, H. (Medizinische Akademie, Erfurt (German Democratic Republic). Radiologische Klinik); Steube, D. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

VERTEBRAE/computerized tomography; VERTEBRAE/skeletal diseases; CONTRAST MEDIA; PATIENTS; VERTEBRAE

32308 (INIS-mf–11404 S111) **Hereditary myopathies in patients free of signs as evidenced by CT.** Gellerich, I. (Medizinische Akademie, Magdeburg (German Democratic Republic). Nervenklinik); Koch, R.D. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MUSCLES/computerized tomography; MUSCLES/hereditary diseases; MUSCLES; PATIENTS

32309 (INIS-mf–11404 S112) **Diagnosis of skeleton and soft tissues by CT and MRT.** Imhof, H. (Vienna Univ. (Austria). Zentrales Inst. fuer Radiodiagnostik). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

MUSCLES/computerized tomography; MUSCLES/nmr imaging; SKELETON/computerized tomography; SKELETON/nmr imaging; BONE JOINTS; CARTILAGE; MUSCLES; NEOPLASMS; OSTEOSARCOMAS; SKELETAL DISEASES; SKELETON

32310 (INIS-mf–11404 S114) **CT studies in planning backbone operation.** Haehnel, H. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Zippel, H.; Lehmann, R. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

VERTEBRAE/computerized tomography; VERTEBRAE/surgery; SKELETAL DISEASES; VERTEBRAE; SURGERY

32311 (INIS-mf–11404 S116) **NMR imaging of aseptic necroses of the head of the femur.** Stuerzer, I. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Grossmann, I.; Toepelmann, I.; Dewey, C.; Lippert, J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

FEMUR/necrosis; FEMUR/nmr imaging; BONE JOINTS; FEMUR; NECROSIS; GRAFTS; KIDNEYS; SENSITIVITY

32312 (INIS-mf–11404 S117) **Value of Gd-DTPA in NMR imaging of inflammatory and neoplastic skeletal diseases.** Reiser, M. (Muenster Univ. (Germany, F.R.). Radiologische Klinik); Erlemann, R.; Peters, P.E. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKELETAL DISEASES/gadolinium complexes; SKELETAL DISEASES/nmr imaging; ABSCESSES; ANTIMITOTIC DRUGS; CHEMOTHERAPY; CONTRAST MEDIA; CYSTS; DTPA; EDEMA; FIBROSIS; INFLAMMATION; NECROSIS; NEOPLASMS; PATIENTS

32313 (INIS-mf–11404 S118) **Morphology of osteogenic and chondrogenic tumors examined by NMR imaging.** Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite); Hamburg Univ. (Germany, F.R.). Radiologische Klinik und Strahleninstitut. 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'*. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SARCOMAS/nmr imaging; SKELETAL DISEASES/sarcomas; BONE MARROW; CONTRAST MEDIA; CYSTS; DTPA; GADOLINIUM COMPLEXES; MUSCLES; OSTEOSARCOMAS; SARCOMAS; SARCOMAS

32314 (INIS-mf–11404 S119) **Comparison of MRT and CT in malignant bone tumors.** Stuerzer, I. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Rotte, K.H.; Grossmann, I.; Kriedemann, E.; Schmidt-Peter, P.; Dewey, C. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKELETON/computerized tomography; SKELETON/nmr imaging; BONE MARROW; CARCINOMAS; COMPARATIVE EVALUATIONS; MUSCLES; OSTEOSARCOMAS; PATIENTS; SKELETON

32315 (INIS-mf–11404 S120) **Comparison of NMR imaging and scintigraphic findings in malignant bone tumors.** Markwardt, J. (Akademie der Wissenschaften der DDR, Berlin (German Democratic Republic). Zentralinstitut fuer Krebsforschung); Stuerzer, I.; Dewey, C.; Schmidt-Peter, P.; Grossmann, I. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKELETAL DISEASES/nmr imaging; SKELETAL DISEASES/scintiscanning; CARCINOMAS; COMPARATIVE EVALUATIONS; CYSTS; NECROSIS; PATIENTS; SARCOMAS; SCINTISCANNING; TECHNETIUM 99

32316 (INIS-mf–11404 S121) **NMR imaging of the knee-joint cartilage using 3D volume imaging combined with a fast computer for image processing.** Bohndorf, K. (Klinikum der RWTH, Aachen (Germany, F.R.). Abt. Radiologische Diagnostik und Abt. Anatomie); Adam, G.; Drobnitzky, M.; Prescher, A.; Guenther, R.W. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BONE JOINTS/skeletal diseases; NMR IMAGING/image processing; CARTILAGE; COMPUTERS; LEGS; PATHOLOGICAL CHANGES; PATIENTS

32317 (INIS-mf–11404 S122) **CT in relapsing dislocation of the shoulder joint.** Grasshof, H. (Medizinische Akademie, Magdeburg (German Democratic Republic). Radiologische Klinik); Butz, C.; Freitag, J.; Gellerich, I. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BONE JOINTS/computerized tomography; BONE JOINTS/skeletal diseases; ARMS; PATIENTS

32318 (INIS-mf–11404 S123) **Role of computer tomography in the diagnostics of some diseases of the orbit.** Lazarova, I. (Meditsinska Akademiya, Sofia (Bulgaria). Katedra po Rentgenologiya i Radiologiya); Petkov, D. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKULL/computerized tomography; SKULL/eyes; CYSTS; JAW; METASTASES; NEOPLASMS; PATIENTS; SKULL; EYES

32319 (INIS-mf–11404 S124) **Value of CT in monitoring preoperative chemotherapy of osteosarcomas.** Rotte, K.H. (Akademie der Wissenschaften der DDR, Berlin (German Democratic Republic). Zentralinstitut fuer Krebsforschung); Kriedemann, E.; Geyer, J.; Kunde, D.; Melcher, J.; Perlick, E.; Schmidt-Peter, P. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

OSTEOSARCOMAS/computerized tomography; CHEMOTHERAPY; OSTEOSARCOMAS; PATIENTS; SURGERY

32320 (INIS-mf–11404 S126) **Procedure of the three-dimensional representation of tomographic image arrays.** Hoehne, K.H. (Inst. fuer Mathematik und Datenverarbeitung in der Medizin, Hamburg (Germany, F.R.)); Bomans, M.; Tiede, U.; Riemer, M.; Pommert, A. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/image processing; NMR IMAGING/image processing; DIMENSIONS; IMAGES; SURFACES

32321 (INIS-mf–11404 S127) **Status and trends of digital image transmission and image storage.** Kamm, K.F. (Philips Medizin Systeme G.m.b.H., Hamburg (Germany, F.R.)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/communications; COMPUTERIZED TOMOGRAPHY/digital systems; BIOMEDICAL RADIOGRAPHY; COMMUNICATIONS; IMAGES; STORAGE

32322 (INIS-mf–11404 S128) **System configuration and functional characteristics of the structured Siemens picture archiving and communication systems (PACS).** Greinacher, C.F.C. (Siemens A.G., Erlangen (Germany, F.R.). Unternehmensbereich Medizinische Technik). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/communications; COMPUTERIZED TOMOGRAPHY/digital systems; BIOMEDICAL RADIOGRAPHY; COMMUNICATIONS; IMAGES; STORAGE

32323 (INIS-mf–11404 S129) **Three-dimensional representation in neuroradiology.** Breit, A. (Staedtisches Krankenhaus Spandau-Nord, Berlin (Germany, F.R.). Strahleninstitut); Obletter, N. Humboldt-Universitaet, Berlin (German Democratic Republic) Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/nmr imaging; SPINAL CORD/nmr imaging; BRAIN; DIMENSIONS; NEOPLASMS; SPIN ECHO

32324 (INIS-mf–11404 S130) **Computed radiography with laser-stimulated luminescence.** Boijsen, E. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BIOMEDICAL RADIOGRAPHY/digital systems; BIOMEDICAL RADIOGRAPHY/laser radiation; COMMUNICATIONS; COMPUTERIZED TOMOGRAPHY; IMAGE PROCESSING; LUMINESCENCE; NMR IMAGING; SCINTISCANNING

32325 (INIS-mf–11404 S132) **Diagnosis of skeleton and soft parts by CT and MRT.** Heller, M. (Universitaetskrankenhaus Eppendorf, Hamburg (Germany, F.R.). Radiologische Klinik). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKELETON/computerized tomography; SKELETON/nmr imaging; BLOOD VESSELS; MUSCLES; NEOPLASMS; SKELETON; SPINAL CORD

32326 (INIS-mf–11404 S133) **Indications and limits of CT from the orthopaedist's point of view.** Heitner, H. (Rostock Univ. (German Democratic Republic). Radiologische Klinik); Blaschke, U. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKELETAL DISEASES/computerized tomography; NEOPLASMS; SKELETON

32327 (INIS-mf–11404 S135) **Native CT of the soft parts of the shoulder.** Dihlmann, W. (Roentgeninstitut am A.K., Hamburg-Barmbeck (Germany, F.R.)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BONE JOINTS/computerized tomography; ARMS; MUSCLES

32328 (INIS-mf–11404 S136) **Nuclear magnetic resonance imaging in chronic hemodialysis associated musculoskeletal amyloidosis.** Baert, A.L. (Leuwen University Hospitals (Belgium). Dept. of Radiology); Gielen, J.; Marchal, G.; Holsbeck, M. van; Hecke, P. van. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKELETAL DISEASES/nmr imaging; BONE JOINTS; MUSCLES; SKELETON

32329 (INIS-mf–11404 S137) **MR tissue characterization in the follow-up of primary musculoskeletal tumors.** Vanel, D. (Grenoble-1 Univ., 38 (France). Inst. des Isotopes Radioactifs); Contesso, G.; Coffre, C.; Missenard, G.; Spielmann, M. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKELETAL DISEASES/nmr imaging; FIBROSIS; INFLAMMATION; MUSCLES; NECROSIS; NEOPLASMS; SKELETON

32330 (INIS-mf–11404 S138) **Comparison of intraventricular and parenchymal brain hemorrhage in clinical and CT picture.** Kalvach, P. (Karlova Univ., Prague (Czechoslovakia)); Vymazal, J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; BRAIN/hemorrhage; BRAIN; HEMORRHAGE

32331 (INIS-mf–11404 S139) **What kind of advantages offers MRT compared with CT in imaging spontaneous intracerebral hematomas.** Schuetz, H.J. (Zentrum fuer Neurologie und Neurochirurgie, Giessen (Germany, F.R.). Neurologische Klinik); Lochner, B. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; BRAIN/hemorrhage; BRAIN/nmr imaging; BRAIN; HEMORRHAGE; COMPARATIVE EVALUATIONS

32332 (INIS-mf–11404 S140) **Subcortical arteriosclerotic encephalopathy (SAE) in CT and clinical study.** Kalvach, P. (Karlova Univ., Prague (Czechoslovakia)); Schickerova, R.; Vymazal, J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CEREBRUM/computerized tomography; CEREBRUM/ischemia; ARTERIOSCLEROSIS; CEREBRUM; ISCHEMIA; PATIENTS

32333 (INIS-mf–11404 S141) **Importance of the complex radiological diagnosis for the decision on therapeutical treatment of malformations of cerebral blood vessels.** Kachel, R. (Medizinische Akademie, Erfurt (German Democratic Republic). Radiologische Klinik); Basche, S.; Assmann, H.; Pothe, H.; Hamm, K.D. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BLOOD VESSELS/malformations; BRAIN/blood vessels; THERAPY/planning; BIOMEDICAL RADIOGRAPHY; MALFORMATIONS; BRAIN; COMPUTERIZED TOMOGRAPHY; NMR IMAGING; THERAPY; PLANNING

32334 (INIS-mf–11404 S142) **Dynamic computerized tomography of the brain.** Reichmuth, B. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Michalik, M.; Wolf, M.; Harms, L. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; ARTERIOSCLEROSIS; BRAIN; NEOPLASMS

32335 (INIS-mf–11404 S143) **Comparison of cerebral SPECT with CT in diagnosis of acute cerebrovascular insufficiency.** Eisenberg, B.M. (Regierungskrankenhaus, Berlin (German Democratic Republic)); Linss, G.; Kant, L.; Boettner, R.; Behlke, M.; Hasert, V. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/computerized tomography; BRAIN/ischemia; BLOOD VESSELS; BRAIN; ISCHEMIA; COMPARATIVE EVALUATIONS; PATIENTS; RADIOPHARMACEUTICALS

32336 (INIS-mf–11404 S144) **Comparison of CT and MRT in intracranial inflammations and infections.** Henkes, H. (Freie Univ. Berlin (Germany, F.R.)); Schoemer, W.; Bittner, R.; Felix, R. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/aids; BRAIN/inflammation; SKULL/computerized tomography; SKULL/nmr imaging; BRAIN; AIDS; INFLAMMATION; COMPARATIVE EVALUATIONS; INFECTIOUS DISEASES; PATIENTS; SKULL

32337 (INIS-mf–11404 S145) **Neuroradiological changes in AIDS.** Hunsdiek, F.W. (Freie Univ. Berlin (Germany, F.R.). Klinikum Steglitz); Trittmacher, S.; Purmann, H. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

AIDS/computerized tomography; AIDS/nmr imaging; AIDS; BRAIN; PATHOLOGICAL CHANGES; PATIENTS

32338 (INIS-mf–11404 S147) **Optimization of Magnevist doses in NMR imaging of brain tumors.** Planitzer, J. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)); Michalik, M.; Dewey, C.; Haustein, J. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BRAIN/nmr imaging; CONTRAST MEDIA/optimization; BRAIN; OPTIMIZATION; NEOPLASMS

32339 (INIS-mf–11404 S148) **New developments in measuring bone density by quantitative CT.** Kalender, W.A. (Siemens A.G., Erlangen (Germany, F.R.)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SKELETON/computerized tomography; SKELETON/density; SKELETON; DENSITY

32340 (INIS-mf–11404 S149) **Development of the fields of application of NMR imaging and NMR spectroscopy.** Hartl, W. (Siemens A.G., Erlangen (Germany, F.R.)). Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

BONE JOINTS/nmr imaging; BONE JOINTS/nmr spectra; METABOLISM/nmr imaging; METABOLISM/nmr spectra; HYDROGEN 1; METABOLISM; PHOSPHORUS 31

32341 (INIS-mf–11404 S150) **New independent multi user/multi tasking radiotherapy treatment planning-system with on- and off-line datatransfer from CT or NMR.** Hoen, J. (Marienhospital, Stuttgart (Germany, F.R.). Radiologische Klinik); Metzger, H. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

RADIOTHERAPY/planning; COMPUTERIZED TOMOGRAPHY; DATA TRANSMISSION; NMR IMAGING; RADIOTHERAPY; PLANNING

32342 (INIS-mf–11404 S151) **What are the limits of a CT examination in diagnosing adrenal tumours?.** Pana, I. (Coltea Radiologic Clinic and Fundeni, Bucarest (Romania)); Georgescu, S.A.; Rosu, V. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ADRENAL GLANDS/computerized tomography; ADRENAL GLANDS/neoplasms; NEOPLASMS

32343 (INIS-mf–11938) **Measurements of regional cerebral blood flow (rCBF) using dynamic single-photon emission computed tomography (DSPECT): Definition of a generally acceptable normal range and follow-up checks after extracranial bypass surgery.** Kreisig, T. Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin. 9 Oct 1986. 140p. (In German). Order Number DE89774679/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

The usefulness of dynamic single-photon emission computed tomography was evaluated in 50 volunteers with unobtrusive cerebral findings, who were to provide the relevant standard values. It was found that the values measured were easily reproducible. Measurements in patients showing cerebrovascular disease that were carried out before and after extracranial bypass surgery did mostly not suggest any perceivable improvement of cerebral blood flow. In isolated cases the cerebral reserve was influenced favourably, as judged from measurements after administration of acetazolamide. (MBC).

32344 (INIS-mf–11939) **Results of postoperative radiotherapy and radiation of recurrent tumours, observed in adenomas of the pituitary gland operated at a primary stage.** Oettle, E. Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin. 17 Feb 1987. 125p. (In German). Order Number DE89774678/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

This retrospective study included 134 patients showing adenomas of the pituitary gland. It was found that radiotherapy carried out immediately after surgery was superior to radiation commencing only after tumour recidivation. Treatment was predominantly based an 'ultrahard' X-rays (betatron), to a lesser extent on cobalt-60 gamma rays. (MBC).

32345 (INIS-mf–11954) **Comparison of various methods relating to radionuclide examination of the thyroid gland.** Kutz, D. Technische Hochschule Aachen (Germany, F.R.). Medizinische Fakultaet. 24 Jul 1986. 58p. (In German). Order Number DE89774608/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

The quality of the medical images obtained using as a scintillation detector device either a gamma camera with pinhole collimator, a gamma camera with parallel hole collimator or a scanner equipped with a focussing collimator was compared on the basis of visual evaluation of 140 scintigrams of the thyroid, prepared following administration of 99 mTc pertechnetate. The following conclusions could be drawn: Decisive advantages of the scanner were colour contrast, non-distorted organ visualisation and uncomplicated localisation of palpatory findings. The images provided by the gamma camera and parallel hole collimator turned out to be unsatisfactory despite the use of such processing techniques as smoothing and contrast enhancement. The scintigrams obtained using the camera with pinhole collimator were characterized by the highest resolution capacity and thus permitted any details to be ascertained with a high degree of accuracy. Information in excess of the findings revealed by the scintiscanner and parallel hole collimator was provided in 40% and 55% of cases, respectively.

32346 (INIS-mf–11955) **Cerebral tumours in adults. A review of results achieved with radiotherapy.** Fischer, H. Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet. 27 Feb 1987. 76p. (In German). Order Number DE89774607/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

This retrospective study analyses the results following postoperative radiotherapy of cerebral tumours, where the diagnosis had been confirmed on a histological basis. Grade II astrocytomas were found to respond better to treatment at dosages exceeding 60 Gy. Moreover, the combined use of surgery, radiation and chemotherapy proved superior to that of surgery and radiotherapy alone. (MBC).

32347 (INIS-mf–11956) **Prospective study on the behaviour of values obtained by organ function studies, in particular scintiscan studies of pulmonary perfusion, during treatment of little to moderately advanced tuberculosis, shown by X-rays to involve one lobe of the lung.** Schaffartzik, W. Freie Univ. Berlin (Germany, F.R.). 17 Feb 1987. 104p. (In German). Order Number DE89774605/JAW. Available from NTIS (US Sales Only), PC A06/MF A01.

Prospective study on the behaviour of values obtained by organ function studies, in particular scintiscan studies of pulmonary perfusion, during treatment of little to moderately advanced tuberculosis,

shown by X-rays to involve one lobe of the lung. This prospective study analyses features of global and regional pulmonary function in 14 patients with little to moderately pronounced tuberculosis, shown by X-rays to involve one lobe of the lung. At the beginning of treatment, the global function values were not different from the values generally accepted as normal. Disturbed perfusion was determined in pulmonary sections where the X-ray pictures had revealed the presence of tuberculous foci. After therapy and inactivation of the tuberculosis the values were seen to remain unchanged. (MBC).

32348 (LA–11579-C) **Proceedings of the DOE workshop on the role of a high-current accelerator in the future of nuclear medicine.** Moody, D.C.; Peterson, E.J. (comps.). Los Alamos National Lab., NM (USA). May 1989. 39p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8808225–: DOE workshop on the role of a high-current accelerator in the future of nuclear medicine, Los Alamos, New Mexico, USA, 16-17 Aug 1988). Order Number DE89011356/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The meeting was prompted by recent problems with isotope availability from DOE accelerator facilities; these difficulties have resulted from conflicting priorities between physics experiments and isotope production activities. The workshop was a forum in which the nuclear medicine community, isotope producers, industry, and other interested groups could discuss issues associated with isotope availability (including continuous supply options), the role of DOE and industry in isotope production, and the importance of research isotopes to the future of nuclear medicine. The workshop participants endorsed DOE's presence in supplying radioisotopes for research purposes and recommended that DOE should immediately provide additional support for radionuclide production in the form of personnel and supplies, DOE should establish a policy that would allow income from sales of future "routine" radionuclide production to be used to support technicians, DOE should obtain a 70-MeV, 500-μA variable-energy proton accelerator as soon as possible, and DOE should also immediately solicit proposals to evaluate the usefulness of a new or upgraded high-energy, high-current machine for production of research radionuclides. This proceedings volume is a summary of workshop sessions that explored the future radionuclide needs of the nuclear medicine community and discussed the DOE production capabilities that would be required to meet these needs.

32349 (LA-UR–89-1207) **Copper-67 labeled porphyrin localization in inflamed tissues.** Cole, D.A.; Mercer-Smith, J.A.; Norman, J.K.; Bullington, K.P.; Roberts, J.C.; Lavellee, D.K. Los Alamos National Lab., NM (USA). 1989. 27p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8904209–1: American Chemical Society Division of Agricultural and Food Chemistry symposium on copper bioavailability and metabolism, Dallas, Texas, USA, 10-14 Apr 1989). Order Number DE89011190/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A series of experiments compared the uptake of 5,10,15,20-tetrakis(4-carboxyphenyl) porphinato [^{67}Cu] copper(II), ^{67}CuTCPP, by the lymph nodes of inflamed and two sets or control rats. The results demonstrate that ^{67}CuTCPP localizes in greater concentration in inflamed lymph nodes than in noninflamed control lymph nodes. This enhanced uptake of ^{67}CuTCPP by inflamed lymph nodes was 3.6 times greater than was the uptake by control lymph nodes. A time course study demonstrated that the uptake of ^{67}CuTCPP inflamed lymph nodes reached the maximum level by 24 hours post-injection of ^{67}CuTCPP and remained constant throughout the 96 hours examined. It was also found that the uptake of ^{67}CuTCPP by inflamed lymph nodes was not exclusively dependent upon an increase in the weight of inflamed lymph nodes. These studies show that ^{67}CuTCPP has potential as a lymphoscintigraphy agent. 29 refs., 5 figs., 1 tab.

32350 (OEVS-Mitteilung–1988, pp. 143-147) **Radiation exposure of the population in Federal Republic of Germany from X-ray diagnosis. Trends and alternative diagnostic methods.** Schwarz, E.R. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene); Tsavachidis, C.; Hinz, G.; Kaul, A. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Novel imaging diagnostic techniques have been developed in recent years, which are not based on ionizing radiations. In 1976-1984 an inquiry was made by the German authorities on the diagnostic techniques used in clinics and practices. The amount of X-ray use for the abdominal region has declined, and the amount of sonography increased. 11 refs., 5 tabs. (qui).

32351 (OEVS-Mitteilung–1988, pp. 681-685) **Radiation burden in X-ray examinations of facial skull.** Lotritsch, K.H. (Zentralroentgen des Ambulatorium Sued der Wiener Gebietskrankenkassa, Vienna (Austria)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

X-ray examinations are an easy and reliable method of diagnosing sinusitis, one of the most common illnesses; they are also of great importance in the diagnosis of tumors in the viscerocranium. This explains the frequent use of X-ray examination techniques in this area. Naturally, organs with different radiosensitivity are exposed to radiation. An Alderson-Rando anatomical model, with dosimeters in characteristic places, was exposed to radiation under normal conditions of four standard examination methods. The use of X-ray techniques in diagnostics in the viscerocranium is evaluated and the relation between the received dose and its biological significance is discussed. 6 refs., 2 figs., 2 tabs.

32352 (OEVS-Mitteilung–1988, pp. 650-655) **Gonadal doses in various radiotherapeutic procedures.** Wandl-Hainberger, I. (Universitaetsklinik fuer Strahlentherapie und Strahlenbiologie Wien, Vienna (Austria)); Binder, W.; Wandl, E.O.; Schmidt, W. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Data on doses received in the testes during radiotherapy of brain-head- and neck tumors in men, as well as ovarian doses from brain-, head-, neck- and breast tumor therapies in women are given. Generally, gonadal function is impaired depending on the integral dose and the fractination scheme used. None of the doses measured come into reach of endangering fertility. However radiation can induce mutations whose risk is difficult to assess. A larger risk of congenital malfunctions in children of parents undergoing radiotherapy could not be proven. 6 refs. (qui).

32353 (PB–89-859979/XAB) **Digital-image archiving systems in diagnostic radiology: picture-archiving and communication systems. January 1975-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 99p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the digital image networks and picture archiving and communication systems (PACS) utilized is medical imaging. PACS refers to a technology that manages the vast amount of radiological images and information by means of computer network for the purpose of archiving, distributing, communicating, displaying, and processing the data throughout the radiology service and hospital complex. This emerging concept as the product of many advances in computer technologies such as digital image generation, digital image processing, high-density mass electronic storage, data communication, data base management systems, and electronic display systems. The following major subsystems are also dealt with: data base management systems; workstations; interfacing with subsystems; communication systems;

and other devices. Descriptions of specific systems are included. (Contains 157 citations fully indexed and including a title list.)

32354 **Positron emission computed tomography.** Grover, M. (UCLA School of Med., Los Angeles, CA (US)); Schelbert, H.R. v.v of Digital cardiac imaging. Buda, A.J.; Delp, E.J. Martinus Nujhoff Publishing, Hingham, MA (1985).

Regional mycardial blood flow and substrate metabolism can be non-invasively evaluated and quantified with positron emission computed tomography (Positron-CT). Tracers of exogenous glucose utilization and fatty acid metabolism are available and have been extensively tested. Specific tracer kinetic models have been developed or are being tested so that glucose and fatty acid metabolism can be measured quantitatively by Positron-CT. Tracers of amino acid and oxygen metabolism are utilized in Positron-CT studies of the brain and development of such tracers for cardiac studies are in progress. Methods to quantify regional myocardial blood flow are also being developed. Previous studies have demonstrated the ability of Positron-/CT to document myocardial infarction. Experimental and clinical studies have begun to identify metabolic markers of reversibly ischemic myocardium. The potential of Positron-CT to reliably detect potentially salvageable myocardium and, hence, to identify appropriate therapeutic interventions is one of the most exciting applications of the technique.

32355 **Determination of the absolute configuration of (-)-(2R)-succinic-2-d acid by neutron diffraction study: Unambiguous proof of the absolute stereochemistry of the NAD$^+$/NADH interconversion.** Yuan, H.S.H. (Univ. of Southern California, Los Angeles (USA)); Stevens, R.C.; Fujita, S.; Watkins, M.I.; Koetzle, T.F.; Bau, R. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(9): 2889-2893 (May 1988). DOE Contract AC02-76CH00016.

The absolute configuration of the CHD group (D = deuterium) in (-)-(2R)-succinic-2-d acid, as prepared from (-)-(2S,3R)-malic-3-d acid, has been shown unambiguously to be R by the technique of single-crystal neutron diffraction. The optically active cation (+)-phenylethylammonium was used as the chiral reference. The structure of $[C_6H_5CH_3CHNH_3]^+[HOOCCH_2CHDCOOO]^-$ has been studied with x-ray diffraction at room temperature and neutron diffraction at room temperature and neutron diffraction at 100 K. Crystal data from the neutron diffraction analysis of the phenylethylammonium slat of the title compound at 100 K: space group $P2_1$; a = 8.407 Å, b = 8.300 Å, c = 8.614 Å, β = 91.20°; unit cell volume = 600.9 Å^3, Z = 2. The result confirms the stereochemistry of the malate/succinate transformation, as well as the NAD$^+$/NADH interconversion, and demonstrates the usefulness of the single-crystal neutron diffraction method for determining the absolute configuration of molecules having a chiral monodeuteriomethylene group.

32356 **Changes in Rhodospirillum rubrum cytochrome c_2 and subsequent renaturation: An ^{15}N NMR study.** Yu, L.P. (Univ. of California, Davis (USA)); Smith, G.M. *Proceedings of the National Academy of Sciences of the United States of America (USA),* 85(9): 2894-2898 (May 1988). DOE Contract AC02-76CH00016.

The ^{15}N-enriched ferrocytochrome $c_2$from Rhodospirillum rubrum was studied by ^{15}N NMR at different solvent pH values. The mobility and chemical shift to the N-terminal glutamic acid (335.4 ppm at pH 5.1) were found to depend on pH. It was least mobile between pH 8 and 9.0, which is explained in terms of pH-dependent conformational changes and formation of salt linkages and/or hydrogen bonds. The resonances of the lysine side chains are centered around 341.7 ppm at low pH and move upfield with pH by about 8.4 ppm with pH_a values of 10.8. The exchange rates of the ϵNH protons are lowest near the pK_a values. The protein is very stable in the pH range between 4.9 and 10.0 but unfolds abruptly at pH 10.5-11. Denaturation was verified by the measurement of several parameters by NMR. The renaturation of the protein demonstrates that the folding begins with reformation of home coordination and establishment of a hydrophobic core, followed by positioning of side chains and peptide backbones linking the nucleation centers. The repositioning processes had time scales of minutes to hours in contrast to the reported values of seconds in some studies.

32357 **Solution structure of apamin determined by nuclear magnetic resonance and distance geometry.** Pease, J.H.B. (Lawrence Berkeley Lab., CA (USA)); Wemmer, D.E. *Biochemistry (USA),* 27(22): 8491-8498 (1 Nov 1988). DOE Contract AC03-76SF00098.

The solution structure of the bee venom neurotoxin apamin has been determined with a distance geometry program using distance constraints derived from NMR. Twenty embedded structures were generated and refined by using the program DSPACE. After error minimization using both conjugate gradient and dynamics algorithms, six structures had very low residual error. Comparisons of these show that the backbone of the peptide is quite well-defined with the largest rms difference between backbone atoms in these structures of 1.34 Å. The side chains have far fewer constraints and show greater variability in their positions. The structure derived here is generally consistent with the qualitative model previously described, with most differences occurring in the loop between the β-turn (residues 2-5) and the C-terminal α-helix (residues 9-17). Comparisons are made with previously derived models from NMR data and other methods.

5507 Microbiology

Refer also to citation(s) 30248, 30260, 30262, 30563, 30865, 32207

5508 Morphology

Refer also to citation(s) 30696

5509 Pathology

Refer also to citation(s) 32109, 32110, 32111, 32112, 32113, 32114, 32184

5520 Public Health

Refer also to citation(s) 30284, 30808, 31943, 31944, 31946, 31947, 31948, 31952, 31953, 31954, 31955, 31956, 31957, 31959, 31960, 31962, 31963, 31964, 32405

5530 Agriculture and Food Technology

Refer also to citation(s) 31924, 32014

32358 (INIS-BR–1485) **Isotopes and agriculture.** Malavolta, E. Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil). 1988. 23p. (In Portuguese). (CONF-881289–: 2. week of environment, Piracicaba, Brazil, 5-9 Dec 1988). Order Number DE89613791/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The agriculture disturbes the ecosystems in economical terms with the minimum of irreversible damage. Man's survival in the biosphere will depend on his ability to use four technologies - mechanization, fertilizers, irrigation and pest disease control. The isotopes are usefull to establish means of producing more food and to preserve it; and claims of unbearable damages to the ecosystems caused by fertilizers and pesticides are not true, are presented.

32359 (IVL-B–871) **Farming of rainbow trout in acidified waters. Environmental effects and production prospects.** Larsson, P.E. Swedish Environmental Research Inst., Stockholm. Dec 1988. 43p. (In Swedish). Order Number DE89766910/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

The project have examined environmental effects of fish farming and the prospects of productivity in an acidified watershed. The investigation comprises measurements in the lake, calculations of input substances from the catchment area and from the farming activity. A budget study showing the input to and leakage from the recipient is described. The budget study shows that phosphorus, nitrogen, organic carbon and hydrogen ions are retained in the lake but not sulfur or chloride. The fish farming accounts for 30-40 % of the lakes total input of phosphorus. The corresponding value for nitrogen is 5-10 %. The primary production increased as a result of the increased nutritive salt contribution, but this did not show up until after three years of farming. Phosphorus levels are raised in the sediments underlying the cages. The affected area is restricted to

20-30 m around the establishment. The results indicate good values on growth rate of the trouts, utilization of the feed and meat quality and also a low mortality. (U.W.).

32360 (LUMEDW-MEKN–1004-1-139-1986) **Measurement of regional cerebral blood flow by intravenous administation of 133 xenon. Theory, technique and clinical applications.** Ryding, E. Lund Univ. (Sweden). Dept. of Clinical Physiology. 1986. 42p. Order Number DE89613792/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Reviewing the background and the theory for rCFB measurements the following conditions are established for the use of flow measurement with 133-Xenon as a reliable indicator for indirect measurements of cerebral functional activity. 1. There is a strict coupling between rCBF and regional metabolism. This condition can only be considered to be fulfilled in the normal non-anoxic bran tissue. 2. There is a close correlation between the tissue and the venous concentration of 133-Xenin which can be reliably approximated by the blood-brain partition coefficient. This condition can be considered to be fullfilled in the normal flow range, but not in pathological conditions such as cerebrovascular occlusions. 3. Intercompartment diffusion of 133-Xenon has no significant effect upon the measurement of rCBF values. This condition appear to share its limitations for fulfilement with condition 2. 4. There is no significant contamination by the extracerebral flow components at IH or IV rCBF measurements. 5. There is a negligible 'look through' effect from surrounding areas to region with focal high or low blood flow. (U.W.).

32361 (OEVS-Mitteilung–1988, pp. 875-879) **Radioactivity in milk and milk products from the Chernobyl accident.** Konitzer, B. (Umweltinstitut Muenchen, Muenchen (Germany, F.R.)); Krueger, E.H.; Krueger, L. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Following the initial high contamination of milk with I-131 and Cs-137/134 the recent Cs-levels are well below 10 Bq/l. As a left-over highly contaminated whey is still in storage for the production of food and for animal feeding. The contamination of such whey is 6000 Bq/kg. A wave of higher Cs-contamination in milk is expected for the winter time when hay with contamination levels up to 15000 Bq/kg will be fed to cows. The feeding experiment shows that Cs-levels in milk up to 150 Bq/l will be result. 2 figs.

32362 (OEVS-Mitteilung–1988, pp. 880-884) **Cesium- and iodine contamination of food in South Tyrol, Italy.** Minach, L. (Chemisches Landeslabor, Autonome Provinz Bozen (Italy)); Beggio, P.; Moroder, E.; Brunner, P. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

25 histograms give the iodine 131- and cesium 137 activities in various foods as a function of time for a few months after the Chernobyl accident. A germanium semiconductor spectrum indicates a typical composition of nuclides in the samples. (qui).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 30594, 30726, 30909, 30925, 31847, 31856, 32352, 32396, 32936, 32958

32363 (ACNP–9012652) **American College of nuclear physicians committee to review the facilities report: 1988 edition.** American Coll. of Nuclear Physicians, Washington, DC (USA). c Feb 1989. 24p. Available from American College of Nuclear Physicians, 1101 Connecticut Avenue, N.W., Suite 700, Washington, DC 20036.

This Committee has been charged with the task of updating the recommendations included in the 1976 Report of the Committee on Nuclear Medicine Departmental Facilities to the American College of Nuclear Physicians (ACNP Information Series No. 3). Recent reviews and surveys indicate that the nuclear medicine field has continued to grow. As a result, facilities and staffing in certain areas have been increased since the last report, while some others could be reduced. The expansion of clinical nuclear medicine in the past 12 years has resulted from advances in several fields within and outside this specialty. Newly developed radiopharmaceuticals have directly influenced large increases in hepatobiliary imaging and white blood cell localization procedures. Also, new uses for previously known radioactive tracers brought about widespread performance of studies to detect gastroesophageal reflux, gastric emptying abnormalities, and intestinal bleeding. A better appreciation by cardiologists for the information provided by thallium myocardial imaging led to increasing requests for these studies. This growth was also stimulated by the advent of coronary angioplasty for which tallium imaging is the procedure of choice for deciding on the need for performing the dilation, evaluation of the effect of the procedure and detection of early or late restenosis.

32364 (AD-A–204581/3/XAB) **Potential therapeutic applications for interleukin 1: anti-tumor and hematopoietic effects.** Oppenheim, J.J.; Matsushima, K.; Onozaki, K.; Neta, R. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1987. 11p. (AFRRI-SR–88-7). Available from NTIS, PC A03/MF A01.

Pub. in Mem. Inst. Oswaldo Cruz, Vol. 82, 29-38(1987).

Interleukin 1 (IL 1), a major immunoregulatory monokine, was originally defined by its ability to act as a co-mitogenic factor for murine thymocytes. Since then, IL 1 has been revealed to act as a mediator of host defenses that modulates inflammatory, immunological as well as hematological reactions. This report discusses two distinct effects of IL 1 with potential therapeutic applicability: first, antitumor cell activities and second, the bone marrow restorative activities that probably account for the radioprotective effects of IL 1. There is in vitro and in vivo evidence that IL 1 may play an important role in host defense against tumors by augmenting in vitro monocyte-mediated tumor cytotoxicity by augmenting in vitro NK cell activity by having direct in vitro antiproliferative and cytocidal effects for some tumor cells, and by inducing in vivo tumor regression in mice. It is also shown that administration of IL 1 protects mice from death. This increased survival was paralleled by the recovery of the hematopoietic system from radiation damage. In the course of investigating the reasons for the marrow (BM) restorative effects of IL 1, it was observed that administration of IL 1 to normal mice markedly increases cycling of bone marrow cells. These observed properties of IL 1 induction of BM cell cycling, differentiation of leukemic cell, and its cytostatic effect may have therapeutic utility.

32365 (AD-A–204597/9/XAB) **Contributions to the plenary meeting of cospar (Committee on Space Research) (27th) held in Helsinki, Finland 18-29 July 1988.** Letaw, J.R. Severn Communications Corp., Millersville, MD (USA). 18 Jul 1988. 37p. (SCC–88-04). Available from NTIS, PC A03/MF A01.

This report contains preprint of three papers presented at the XXVII Plenary Meeting of the Committee on Space Research (COSPAR): Radiation Hazards on Space Missions Outside the Magnetosphere; Model Analysis of Space Shuttle Dosimetry Data; and Galactic Cosmic Rays and Cell-Hit Frequencies outside the Magnetosphere.

32366 (AD-A–204598/7/XAB) **Astronaut radiation exposure in low-earth orbit. Part 1. Galactic cosmic radiation.** Letaw, J.R. Severn Communications Corp., Millersville, MD (USA). 31 Mar 1988. 45p. (SCC–88-01). Available from NTIS, PC A03/MF A01.

In recent years, there has been increasing concern about the radiation doses that will be suffered by astronauts on present-day and future space missions. In order to characterize radiation exposure risks on space missions one requires models of space-radiation

environments, codes for transporting the components of ionizing radiation, and procedures for assessing radiation risks of a given exposure. To verify their accuracy, predictions based on these transport results must then be compared with existing dosimetry data. Linear energy transfer (LET) spectra, absorbed dose, and dose equivalent from galactic cosmic radiation and its fragments are presented for four, representative low-earth orbit configurations. The orbits include a high (STS-51J) and low (STS-61C) altitude, low-inclination (28.5 degs) flight; a high inclination (49.5 degs) flight (STS-51F); and a polar flight. Results are compared with computations for an exo-magnetospheric flight.

32367 (BNL–42416) **Alternatives to dose, quality factor and dose equivalent for low level irradiation.** Sondhaus, C.A.; Bond, V.P.; Feinendegen, L.E. Brookhaven National Lab., Upton, NY (USA). 1988. 29p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8810306–2: Workshop on recent advances in biological sciences, low dose and low dose rate ionizing radiation, San Diego, California, USA, 18-20 Oct 1988). Order Number DE89010250/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Randomly occurring energy deposition events produced by low levels of ionizing radiation interacting with tissue deliver variable amounts of energy to the sensitive target volumes within a small fraction of the cell population. A model is described in which an experimentally derived function relating event size to cell response probability operates mathematically on the microdosimetric event size distribution characterizing a given irradiation and thus determines the total fractional number of responding cells; this fraction measures the effectiveness of the given radiation. Normalizing to equal numbers of events produced by different radiations and applying this cell response or hit size effectiveness function (HSEF) should define radiation quality, or relative effectiveness, on a more nearly absolute basis than do the absorbed dose and dose evaluation, which are confounded when applied to low level irradiations. Examples using both calculation and experimental data are presented. 15 refs., 18 figs.

32368 (CONF-880514–Absts.) **Biological assessment of occupational exposure to actinides: Programme; Book of Abstracts.** CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire; USDOE Office of Energy Research, Washington, DC (USA). Office of Health and Environmental Research; Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development. 1988. 108p. Sponsored by DOE/ER;FOR. From Workshop on biological assessment of occupational exposure to actinides; Versailles, France; 30 May - 2 jun 1988. Order Number DE89011549/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI.

In publication 30, the International Committee on Radiological Protection (ICRP) has recommended Annual Limits on Intake (ALIs) for persons who are occupationally exposed to radioactive materials. In general, however, the ALIs are derived for radiochemically pure compounds, and as a consequence may not always be appropriate to industrial situations. In the nuclear industry, persons are exposed to actinides in a wide range of chemical forms, often in association with other radioactive or inactive materials, which can influence their retention characteristics in the lung, gut and other tissues. In these circumstances the application of the ALIs recommended by ICRP may be inappropriate. Procedures are therefore needed for assessing the consequences of human exposure to actinides in industrially produced compounds, for establishing 'site specific' limits on intake, and also for interpreting whole body monitoring and bioassay data. This document contains the abstracts of 45 presented papers.

32369 (CONF-8607379–Summs.) **ASA conference on radiation and health, Coolfont VI: Final report.** American Statistical Association, Washington, DC (USA). May 1988. 41p. Sponsored by DOE/ER;NRC;OGA. DOE Contract FG05-87ER60558. From Coolfont VI: 6. annual American Statistical Association (ASA) conference on radiation and health; Berkeley Springs, West Virginia, USA; 20-25 Jul 1986. Order Number DE89011529/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The 1986 ASA Conference on Radiation and Health (Coolfont VI) continued the procedure established in 1981 of holding forenoon and evening sessions, leaving afternoons free for discussion and relaxation. One exception was made this year in that Michael and Marie Stoline were invited to discuss the Chernobyl Disaster on Monday afternoon. The program consisted of the following topics: a general overview of radiation and health problems; cytogenetics and radiation (human and animal studies and statistical analysis of dose-response curves); uranium and health effects, including continuing emphasis on radon, which has attracted considerable national interest lately; epidemiologic studies of workers at nuclear power plants and an uranium processing plant; the latest assessment of atomic bomb dosimetry. These Coolfont Conferences provide an excellent environment for an interchange of ideas and information in an assemblage of scientists from a variety of disciplines. Unfortunately there is one important factor which limits this interchange: language. In order to overcome the difficulty of statisticians understanding nuclear scientists and nuclear scientists understanding statisticians, I suggested one of two procedures: each group prepare a set of commonly used terms with definitions which would be understood by the other group(s); have an introductory session in which each group attempts to explain its language to the other group(s). This problem of communication is even more serious when scientists attempt to explain their research efforts to the general public. The Coolfont Conferences on Radiation and Health should be ideal forums for development of a language which could be understood by the general public as well as different scientific groups. This document contains the abstracts of 12 presented papers.

32370 (CONF-8707194–Summs.) **ASA conference on radiation and health: Coolfont 7: Final report.** American Statistical Association, Alexandria, VA (USA). 1987. 53p. Sponsored by DOE/ER;NRC. DOE Contract FG05-86ER60466. From 7. annual American Statistical Association (ASA) conference on radiation and health; Berkeley Springs, West Virginia, USA; 12-17 Jul 1987. Order Number DE89011528/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

These proceedings provide a summary of papers presented at the seventh annual ASA Conference on Radiation and Health, held at the Coolfont Conference Center in Berkeley Springs, West Virginia. More than forty scientists, including statisticians, epidemiologists, biologists, and physicists, participated in the conference. The 1987 conference focused on lung cancer risks, especially lung cancer risks due to radon. The BEIR IV report, which addresses health risks of radon and other internally deposited alpha-emitters, was summarized early in the conference. Results of analyses of data on miners in Colorado and in New Mexico were presented, as well as analyses of combined data from several studies, which were used as the basis of estimates in the BEIR IV report. Statistical issues related to appropriate analysis of chronic exposure and of smoking data received considerable attention and discussion. Papers describing models for lung cancer risks based on exposure to cigarette smoke, radiation, and other substances provided insights into general understanding of lung cancer mechanisms. Carcinogenic models were also the subject of a presentation on radiation-induced skin cancer in humans and animals. In addition, relevant data on animal experiments involving radon exposure were summarized. Understanding risks requires relating them to dose, and thus the presentation on dosimetry, both for miner populations and for residents of US homes, made an important contribution to the conference. Presentations on current efforts at the state and national level to assess radon levels in US homes were also of considerable interest to the participants. Individual papers were processed separately for the data base.

32371 (CONF-8904203–2) **"Normal" tissues from humans exposed to radium contain an alteration in the c-mos locus.** Huberman, E.; Schlenker, R.A.; Hardwick, J.P. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Cell transformation systems relevant of radiation-induced cancer in man; Dublin, Ireland; 4-7 Apr 1989. Order Number DE89013196/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The structures of a number of human proto-oncogenes from persons with internal systemic exposure to radium were analyzed by restriction enzyme digestion and southern blotting of their DNA. Two extra c-mos Eco R1 restriction-fragment-length bands of 5.0 kb and

5.5 kb were found in tissue DNA from six of seven individuals. The extra c-mos bands were detected in DNA from many, but not all, of the tissues of the individuals exposed to radium. Our results suggest that the c-mos restriction-fragment-length alterations (RFLA) found in individuals exposed to radium were induced rather than inherited, are epigenetic in origin, and most likely result from changes in the methylation of bases surrounding the single exon of the c-mos proto-oncogene. 7 refs., 3 figs., 2 tabs.

32372 (HEHF–54-88) **United States transuranium registry: Annual report, 1 October 1987–30 September 1988.** Swint, M.J.; Kathren, R.L. Hanford Environmental Health Foundation, Richland, WA (USA). Apr 1989. 27p. Sponsored by DOE Energy Research. DOE Contract AC06-65RL01837. Order Number DE89013611/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The primary objective this year was to initiate evaluation of Registry Case 246, an individual who had incurred the largest recorded human deposition of Am-241 as a result of a chemical explosion in a glove box. Because of the potential importance of this case, invitations for collaborative research were solicited from the scientific community. Other projects during the year included an international intercomparison of radiochemical analysis for actinides in tissue, a comparison of in-vivo and postmortem deposition estimates, a study of the fractionation of Am-241 and Pu-239+40 in skeleton and live, preliminary evaluation and modelling of the second whole body donation to the Registry, and a study of the distribution of actinides in lung and associated lymph nodes. The Registry was invited to participate in two international meetings during the year presenting evaluations and recommendations based on data gathered over more than 20 years of operation. A list of the papers presented at these meetings is included. 17 refs.

32373 (INIS-mf–11406, pp. 66) **Genetic and biochemical basis of radiation sensitivity in cultured human and other mammalian cells.** Buul, P.P.W. van (Rijksuniversiteit Leiden (Netherlands). Lab. voor Stralengenetica en Chemische Mutagenese); Darroudi, F.; Mullenders, L.H.F.; Natarajan, A.T.; Vrieling, H.; Zdzienicka, M.Z.; Lohman, P.H.M. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, Israel, 24-30 Oct 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Order Number DE89610335/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ANIMAL CELLS/radiosensitivity; RADIOSENSITIVITY; CELL CULTURES; DNA REPAIR; EFFICIENCY; GENETIC RADIATION EFFECTS; IN VITRO; MAMMALS; MUTAGENESIS; MUTAGENS

32374 (INIS-SU–81/A, pp. 6-15) **New trends in skin protection from ionizing radiations.** Ivanov, E.V. (Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR)); Dubur, G.Ya. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of scientific papers.* Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

The results of investigation of a new remedy to prevent and to treat radiation skin injuries - diethone a derivative of 1,4- dihydropyridines are considered. Experimental study was carried out on rat and mice skin irradiated with beta- and soft x radiation at 20-60 Gy. The intensity and duration of radiation response is decreased by 50% when using diethone. Diethone surpasses mexamin and cystamine in skin radiation protection. In case of diethone treatment inflammatory processes are reduced, the duration of recovery period is shortened and regeneration is increased. A decrease of radiationinjury and stabilization of intercellular membranes and mitochondria membrane in particular are noted. 28 refs.

32375 (KIYI–88-1, pp. 22-32) **Induction and reparation of DNA strand breaks at neutron and X-ray irradiation at various stages of cell cycle.** Bezdrobnaya, L.K.; Koval', G.N. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). In *Dosimetric plan of distance irradiation.* Order Number DE89780085/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Reparation possibilities of hepatocytes at different stages of all cycle under conditions of irradiated organism as a result of X-radiation of rats in the dose of 10 Gy, and neutron irradiation in the doses of 10 and 20 Gy are investigated. It is found that with an increase in post irradiation time the yield of native DNA increases, which testifyes to the reunion of induced DNA strand breaks. 11 refs.; 4 figs.; 2 tabs.

32376 (NUREG/CR–5353) **Inhaled ^{147}Pm and/or total-body gamma radiation: Early mortality and morbidity in rats.** Filipy, R.E.; Lauhala, K.E.; McGee, D.R.; Cannon, W.C.; Buschbom, R.L.; Decker, J.R.; Kuffel, E.G.; Park, J.F.; Ragan, H.A.; Yaniv, S.S.; Scott, B.R. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; Pacific Northwest Lab., Richland, WA (USA). May 1989. 195p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (PNL–6891). Available from NTIS, PC A09/MF A01 - GPO - OSTI.

Rats were given doses of ^{60}Co gamma radiation and/or lung burdens of ^{147}Pm (in fused aluminosilicate particles) within lethal ranges in an experiment to determine and compare morbidity and mortality responses for the radiation insults within 1 year after exposure. Radiation-induced morbidity was assessed by measuring changes in body weights, hematologic parameters, and pulmonary-function parameters. Acute mortality and morbidity from inhaled promethium were caused primarily by radiation pneumonitis and pulmonary fibrosis that occurred more than 53 days after exposure. Acute mortality and morbidity from total-body gamma irradiation occurred within 30 days of exposure and resulted from the bone-marrow radiation syndrome. Gamma radiation caused transient morbidity, reflected by immediately depressed blood cell levels and by reduced body weight gain in animals that survived the acute gamma radiation syndrome. Inhaled promethium caused a loss of body weight and diminished pulmonary function, but its only effect on blood cell levels was lymphocytopenia. Combined gamma irradiation and promethium lung burdens were synergistic, in that animals receiving both radiation insults had higher morbidity and mortality rates than would be predicted based on the effect of either kind of radiation alone. Promethium lung burdens enhanced the effect of gamma radiation in rats within the first 30 days of exposure, and gamma radiation enhanced the later effect of promethium lung burdens. 70 refs., 68 figs., 21 tabs.

32377 (OEVS-Mitteilung–1988) **4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.** Tschirf, E.; Hefner, A. (Atominstitut der Oesterreichischen Universitaeten, Vienna (Austria)) (eds.). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. 909p. (In German, English). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

153 papers on various aspects of radiation protection (including historical) were presented, 146 of them are in INIS scope. The content is indicated in the session headings: radiation exposure of the public; radioecology, radioactive waste; occupational radiation exposure; regulatory, legal and social aspects of radiation protection; risk assessment and radiation effects; instrumentation; external and internal dosimetry; non-ionizing radiation; Chernobyl session. (qui).

32378 (OEVS-Mitteilung–1988, pp. 338-342) **Is the objective health detriment an useful concept for evaluating the exposure of a population to ionizing radiation?.** Frittelli, L. (ENEA, Rome (Italy)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

To quantify the stochastic effects in an exposed population the ICRP has defined the objective health detriment, proportional to the collective dose equivalent. Owing to the probabilistic relationship between dose and stochastic effects some problems could however

arise in using this concept for low probability exposures. The usefulness of other statistical indicators of occurence of health effects in the exposed population is also discussed. 3 figs.

32379 (OEVS-Mitteilung–1988, pp. 314-319) **Biophysical test methods for radioprotectors.** Reubel, B. (Salzburg Univ. (Austria). Inst. fuer Allgemeine Biologie, Biochemie und Biophysik); Atzmueller, C.; Steinhaeusler, F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Human embryonic lung fibroblasts, exposed to a radon-222-atmosphere, were treated with the radioprotectors vitamin C and cysteamin and with ionized oxygen. Radiation damage, i.e. the formation of hydroxyl radicals in the primary radiochemical phase, was modified to a largely varying degree by different radioprotectors, as indicated by the alteration of the transmembrane resting potential. 7 refs., 5 figs.

32380 (OEVS-Mitteilung–1988, pp. 300-303) **Validity and reliability of results of epidemiological studies for the estimation of the radiation included lung cancer risk.** Schmitt, A.M. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Several studies pertaining to the risk coefficients for the internal - and external exposure of the lung are critically evaluated. For radiation protection purposes, ICRP assumes risk coefficients in the range of 5-15 per 10/sup 6/PY per WLM for internal and 20 per 10/sup 4/per Sv for external lung exposure. The risk coefficient for internal lung exposure, based on results from investigations on American and Czech uranium miners, is in agreement with results from more recent epidemiological studies within the given range. The risk coefficient of 20 per 10/sup 4/per Sv assumed by ICRP for external lung exposure based on results of studies on A-bomb survivors up to 1977, gives information only on the integral lung cancer frequency per dose unit. Assuming a constant annual lung cancer incidence (absolute risk) of up to 25 years after exposure, a coefficient of 0,8 per 10/sup 4/PY per Sv will result. This value is in agreement with recent results from studies on A-bomb survivors and results from ankylosing spondylitis studies. There are indications, however, that the radiation induced lung cancer risk in particular is proportional to the spontaneous lung cancer risk (relative risk model). This leads to the conclusion that the risk coefficient given by ICRP for an observation period of 25 years would underestimate the life time risk, i.e. with longer observation periods in the relevant epidemiological studies, the risk coefficients gained from those studies would become increasingly different from currently assumed ICRP values. 1 ref., 1 tab.

32381 (OEVS-Mitteilung–1988, pp. 370-374) **Twenty-five years of alara.** Carter, M.W. (Office of the Supervising Scientist for the Alligator Rivers Region, Sydney (Australia)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Early ICRP recommendations were interpreted as putting the emphasis on individual dose limits, with no particular incentive to reduce individual doses much below the limit, even though some of the recommendations implied an ALARA approach. Current ICRP recommendations can be interpreted as requiring collective doses to be minimised without special regard for individual doses, provided that they are all below the limit. In spite of these different emphases, the operational health physicist appears to have applied a form of ALARA with emphasis on individual doses throughout the period. It is suggested that for both practical and social reasons emphasis needs to be put on reducing individual doses and sharing the exposures evenly among the work force. To this end a modified ALARA formula is suggested, that places the emphasis on individual doses, but includes collective doses. 14 refs.

32382 (OEVS-Mitteilung–1988, pp. 419-423) **Is there a measurably higher radiation risk for the personnel of a nuclear therapy station?.** Kletter, K. (1. Medizinische Universitaetsklinik, Vienna (Austria)); Havlik, E. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Data for the internal and external radiation burden for the personnel of a nuclear therapy station have been evaluated retrospectively for 51 months. The therapy station is in a provisional state, with minimum constructional radiation protection. The data were compared with persons using open radionuclides for diagnosis. The latter persons had higher whole body as well as partial body burdens. The data collected for incorporation, the thyroid burden from I-131 (used exclusively in the therapy) can be estimated to below 20mGy. In none of the two groups were the limit doses exceeded. The radiation risk assessed does not justify further expensive constructional means. Organisation is sufficient for keeping the radiation burden low. 3 refs., 2 tabs.

32383 (OEVS-Mitteilung–1988, pp. 691-694) **Radiation burden of a critical group of children by K-40 taken by food.** Popovic, D. (School of Veterinary Medicine, Department of Physics, Beograd (Yugoslavia)); Djuric, G. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The paper discusses radiation burden of a critical group of children (age 3-7) by potassium-40 taken by food of animal and plant origin. The estimation is based on the measurements of the absorbed dose of this radionuclide in the investigated samples of food. The absorbed dose was measured by thermoluminiscent dosimeters MgB/sub 4/O/sub 7/:Dy. The results show the actual radiation burden of children by K-40 calculated for the exchangeable fraction of potassium (95% of the total amount of potassium taken into the body by food) to be 1,9 - 3,8 mSv per year, with the possible variations of ±30%. 8 refs., 2 tabs.

32384 (OEVS-Mitteilung–1988, pp. 686-690) **Dose assessment through micronuclei in irradiated human lymphocytes.** Almassy, Z. ('Frederic Joliot-Curie' National Research Institute for Radiobiology and Radiohygiene, Budapest (Hungary)); Kanyar, B.; Koeteles, G.J. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Micronucleus frequencies in human peripheral lymphocytes X- or gamma-irradiated in vitro with doses between 0,5 and 4 Gy were determined. Efficiencies of stainings with fluorochrom acridine orange and Giemsa were compared. Optimal culturing time was found to be 72 hours. The data fitted well to linear-quadratic dose-effect relationship. 9 refs., 2 figs., 2 tabs.

32385 (OEVS-Mitteilung–1988, pp. 661-665) **Risk assessment and the linearity hypothesis.** Wagner, S.R. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The consequences of various assumptions on the shape of dose-response relations are demonstrated and the uncertainties of risk estimates resulting therefrom, from the uncertainties of input data and from evaluation procedures are pointed out. 7 refs., 3 figs.

32386 (OEVS-Mitteilung–1988, pp. 676-680) **Thermography in diagnosis of local radiation injury.** Koeteles, G.J. ('Frederic Joliot-Curie' National Research Institute for Radiobiology and Radiohygiene, Budapest (Hungary)); Kerekes, J.; Sztanyik, L.B.; Lelik, F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A case is reported when a hand of an industrial radiographer was injured from an iridium-192 gamma radiation source. By contact thermography performed by Flexi-Therm/sup R/larger irradiated areas were detected than by clinical observations. Temperature differences between respective parts of the injured and non-injured hands were noticed also in the clinically latent phase of pathological process. Experiments are performed on locally irradiated mini-pigs to reveal time- and dose-dependences of appearances of local alterations of surface temperature by NovaTherm/sup R/. Clinical and experimental experience collected so far suggest that thermography is a sensitive and useful technique to detect local radiation injuries also in the phases when clinical symptoms are not evident, i.e. in the early and latent periods. 7 refs., 2 figs.

32387 (OEVS-Mitteilung–1988, pp. 695-698) **Development of a system for the automatic analysis of chromosome aberrations.** Wittler, C. (Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Strahlenhygiene); Loerch, T.; Stephan, G.; Bille, J. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The frequency of structural chromosome abberation in peripheral human blood lymphocytes can be used for dose estimation in case of suspected radiation exposure. Especially dicentric chromosomes are a very specific indicator of ionizing radiation. The main disadvantage of this biological dosimetry is the great expenditure of human work, which prevents this method from becoming widespread for routine analyses. For this reason a system has been designed and built up which realizes all necessary hardware functions required for automation of most parts of this task. The required high processing speed for image analysis is made available by a real time video preprocessor and the multi-microprocessor-system 'POLYP'. The task of automated analyses is split in metaphase finding and scoring dicentric chromosomes. The metaphase finding program is already in routine use. The segmentation and classification was developed using a large learning set. A false-positive error rate of 0,74% was found. Finally the operator checks all objects classified as dicentrics. 1 fig.

32388 (OEVS-Mitteilung–1988, pp. 666-670) **Dosimetry and radiation risk in diagnostic radiological examinations of the lumbosacral region of the spine: computerized tomography versus functional myelography.** Rahim, H. (Landeskrankenanstalten Salzburg (Austria). Inst. fuer Radiotherapie); Hofmann, W.; Grobovschek, M. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The integral dose obtained for a standard CT-investigation in the lumbosacral region, and for a standard functional myelography examination were compared on the basis of TLD-measurements. The dose experienced by a patient in CT-investigations is approximately a factor 6 higher than in the corresponding myelography examination. 7 refs., 3 figs., 1 tab.

32389 (OEVS-Mitteilung–1988, pp. 786-790) **Bikini accident and Chernobyl accident.** Nishiwaki, Y. (Kinki Univ., Higashi-Osaka, Osaka (Japan). Atomic Energy Research Inst.). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The number of persons evacuated after Chernobyl accident is reported to be about 135000, which is almost comparable to that of the exposed to the atomic bombings at Hiroshima and Nagasaki in 1945. However, in case of atomic bombing, the whole body gamma and neutron radiation is received in an extremely short time, possibly of the order of some nano seconds. In addition, they received strong effects of blast waves, thermal radiation, and other toxic chemicals released to the environment due to destruction of various facilities by bombing. In case of Chernobyl accident, the whole body gamma radiation is received in a much longer time, possibly of the order of some hours, by the evacuees. The dose rate would be greatly different. In this respect, the accidental exposure to the strongly radioactive fallout at Bikini accident in 1954 may be more similar to the case of Chernobyl accident. The author makes some comparison of these cases, because of his involvement in investigation of the past radioactive fallout as observed in Japan. The radioactivity due to Chernobyl accident reached Japan at about 8 days after the accident. The volatile radionuclides such as I 131, Cs 137 were predominant. The radioactivity ratio Cs 137/Cs 134 was about 2. In case of Bikini H-bomb test, all radioactivities are released instantaneously and radioactivities of non-volatile as well as volatile elements were observed. 2 figs.

32390 (PNL–6450-18-HEDR) **Hanford environmental dose reconstruction project: Monthly report.** Dennis, B.S. (comp.). Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 27p. Sponsored by DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE89011853/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of the Hanford Environmental Dose Reconstruction Project is to estimate the radiation doses that populations could have received from nuclear operations at Hanford since 1944. The project is being managed and conducted by Pacific Northwest Laboratory under the direction of an independent Technical Steering Panel. During the reporting period, we continued revision of Work Plan to reflect phased approach, began incorporating comments from TSP Source Terms Subcommittee into a draft report, continued internal PNL clearance of a draft report, began preparing information to be presented at the May TSP meeting on the Columbia River (between Priest Rapids Dam and McNary Dam), completed a draft report summarizing the approach selected for atmospheric modeling, continued developing data bases on meteorological and numerical data, and met with representatives of the Colville, Spokane, Yakima, and Nez Perce tribes to discuss contracts, data collection, proposal revisions, and other aspects of the HEDR Project.

32391 (PNL–6450-19-HEDR) **Hanford Environmental Dose Reconstruction Project: Monthly report, May 1989.** Dennis, B.S. (comp.). Pacific Northwest Lab., Richland, WA (USA). 1989. 26p.

Sponsored by DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE89013082/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of the Hanford Environmental Dose Reconstruction Project is to estimate the radiation doses that populations could have received from nuclear operations at Hanford since 1944. The project is being managed and conducted by Pacific Northwest Laboratory under the direction of independent Technical Steering Panel. The Technical Steering Panel consists of experts in environmental pathways, epidemiology, surface-water transport, ground-water transport, statistics, demography, agriculture, meteorology, nuclear engineering, radiation dosimetry, and cultural anthropology. Included among the members are appointed technical members representing the States of Oregon and Washington, cultural and technical experts nominated by the Indian tribes in the region, and an individual representing the public.

32392 (PNL–6866) **Technical basis for internal dosimetry at Hanford.** Sula, M.J.; Carbaugh, E.H.; Bihl, D.E. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 299p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE89012625/JAW. Available from NTIS, PC A13/MF A01 - OSTI; GPO Dep.

The Hanford Internal Dosimetry Program, administered by Pacific Northwest Laboratory for the US Department of Energy, provides routine bioassay monitoring for employees who are potentially exposed to radionuclides in the workplace. This report presents the technical basis for routine bioassay monitoring and the assessment of internal dose at Hanford. The radionuclides of concern include tritium, corrosion products (^{58}Co, ^{60}Co, ^{54}Mn, and ^{59}Fe), strontium, cesium, iodine, europium, uranium, plutonium, and americium. Sections on each of these radionuclides discuss the sources and characteristics; dosimetry; bioassay measurements and monitoring; dose measurement, assessment, and mitigation; and bioassay follow-up treatment. 64 refs., 42 figs., 118 tabs.

32393 (PNL-SA–16186) **Molecular characterization of x-ray induced mutations at the HGPRT locus in plateau phase Chinese hamster ovary cells: Effect of dose, dose fractionation, and delayed plating.** Morgan, T.L.; Fleck, E.W.; Rossiter, J.F.B.; Miller, J.H. Pacific Northwest Lab., Richland, WA (USA). Mar 1989. 10p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830;AM06-70RL02225. (CONF-8904203–1: Cell transformation systems relevant of radiation-induced cancer in man, Dublin, Ireland, 4-7 Apr 1989). Order Number DE89011208/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Plateau-phase CHO-K1 cells were irradiated to study the effects of dose, dose fractionation and delayed plating on the yield and type of mutations induced by 250 kVp X rays at the HPRT locus. DNA isolated from 89 mutant cell lines was examined by Southern blot analysis using a cDNA HPRT probe. Complete loss of the HPRT locus was the most frequently observed lesion, regardless of treatment protocol. Dose was the only parameter tested which appeared to significantly affect the fraction of full deletions induced by X rays. At 2 Gy, only 43% (9/21) showed a complete loss of HPRT sequences. The proportion of full deletion mutants observed in all other treatment groups (4 Gy, 2 + 2 Gy separated by 24 h and 4 Gy with 24 h delay in replating) combined was 66% (45/68). The specific fraction of full deletions was not altered by repair associated with recovery from sublethal or potentially lethal damage, suggesting that while DNA repair may mitigate the lethal effects of radiation damage, it acts with equal fidelity on all lesions. Evidence will also be discussed which suggests that the distribution of intragenic lesions is nonrandom. 16 refs., 1 fig., 2 tabs.

32394 (UCD–472-133) **Laboratory for Energy-Related Health Research: Annual report, fiscal year 1987.** Abell, D.L. (ed.). California Univ., Davis, CA (USA). School of Veterinary Medicine. Apr 1989. 102p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00472. Order Number DE89012234/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The laboratory's research objective is to provide new knowledge for an improved understanding of the potential bioenvironmental and occupational health problems associated with energy utilization. Our purpose is to contribute to the safe and healthful development of energy resources for the benefit of mankind. This research encompasses several areas of basic investigation that relate to toxicological and biomedical problems associated with potentially toxic chemical and radioactive substances and ionizing radiation, with particular emphasis on carcinogenicity. Studies of systemic injury and nuclear-medical diagnostic and therapeutic methods are also involved. This program is interdisciplinary; it involves physics, chemistry, environmental engineering, biophysics and biochemistry, cellular and molecular biology, physiology, immunology, toxicology, both human and veterinary medicine, nuclear medicine, pathology, hematology, radiation biology, reproductive biology, oncology, biomathematics, and computer science. The principal themes of the research at LEHR center around the biology, radiobiology, and health status of the skeleton and its blood-forming constituents; the toxicology and properties of airborne materials; the beagle as an experimental animal model; carcinogenesis; and the scaling of the results from laboratory animal studies to man for appropriate assessment of risk.

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 30284, 30726, 31936, 32194

32395 (CONF-8811202–) **DOE contractors' meeting on chemicals with living systems.** USDOE Office of Energy Research, Washington, DC (USA). Office of Health and Environmental Research; Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst. 1988. 134p. Sponsored by DOE Energy Research. DOE Contract AC04-76EV01013. From 4. annual DOE contractors' meeting on chemicals with living systems; Albuquerque, New Mexico, USA; 17-18 Nov 1988. Order Number DE89012820/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The Department of Energy's Office of Health and Environmental Research (OHER) held its Fourth Annual Contractor's Meeting, "Interactions of Chemicals with Living Systems" on November 17 and 18, 1988. There were thirty-four attendees at the workshop. The thirty-three presentations, which were from six DOE laboratories and seven universities, focused on current research findings and explored opportunities for future research. The meeting covered a wide spectrum of disciplines and research supported by OHER. It provided a forum at which scientists from diverse, but related, areas summarized current OHER research activities. This successful meeting provided an exceptional opportunity for OHER-supported scientists to exchange information and make new contacts for potential collaboration in research. This document contains an abstract of each presentation and a brief summary of each of the three sessions that were held.

32396 (ISH–124) **Bibliographic study on molybdenum biokinetics.** Erzberger, A. Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene. May 1988. 44p. (In German). Available from Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene.

This bibliographical study compiles and analyzes findings about the metabolism and resorption of molybdenum. Besides including studies on the physiology of molybdenum 99, a general survey is given on molybdenum in the environment and on its physiological behaviour. In particular, information on the dependence of molybdenum resorption on various factors, such as the chemical form, antagonisms etc., are gathered from literature. These factors have to be considered for sensibly carrying out necessary experiments.

32397 (IVL-B–900) **Recovery processes in marine ecosystems.** Jerneloev, A.; Holm, G.; Linden, O. Swedish Environmental Research Inst., Stockholm. Nov 1988. 32p. Order Number DE89766891/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

The investigations of recovery after pollution in the marine ecosystem referred to in this study confirm several of the expectations derived from theoretical ecology. Thus, the timescale is clearly different for ecological subsystems with the pelagial recovering in a water of days or weeks after the end of the pollution, the littoral typically in months or years and the profundal in decades or centuries. Clearly also the recovery process means increase in species diversity, longer foodchains and more efficient energy transfer to higher

trophic levels in the ecosystem. However, in one important aspect the data presented in the studies do not support a concept from theoretical ecology. There is no indication in these studies of an alternative stable position to which the ecosystem would return when the pollution episode removed it from the original balanced state. Therefore, from the studies referred to here it seems that the most pertinent question to study with regard to recovery processes is the time element, it's variation between ecological subsystems, it's dependence on temperature and the interrelation between time for recovery and size of affected area. (authors).

32398 (ORNL/M–775) **TNT metabolites in animal tissues: Quarterly technical progress report No. 2, January 1, 1989–March 31, 1989.** Shugart, L.R. Oak Ridge National Lab., TN (USA). 1 Apr 1989. 15p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. Order Number DE89012282/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objectives of this project are: (1) to provide quantitative analytical procedures for the analysis of TNT and at least eight of its metabolites in animal tissues, and (2) to obtain representative samples of tissues from animals from designated Army sites and to determine the presence or absence of TNT and its metabolites in these samples. The study is divided into two Phases corresponding to the stated overall objectives of the project. 3 figs., 2 tabs.

32399 (ORNL/M–829) **Biological (molecular and cellular) markers of toxicity: Semi-annual technical progress report (No.1), October 1, 1988–March 31, 1989.** McCarthy, J.F. Oak Ridge National Lab., TN (USA). 1 Apr 1989. 13p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. Order Number DE89012365/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of this study is to evaluate the use of a small aquarium fish, the Japanese Medaka, as a predictor of potential health effects following exposure to the carcinogen diethyl nitrosamine (DEN). Research efforts will investigate the dose response relationship that exists between a suite of molecular parameters and the carcinogenic agent with respect to external dose, dose at the target organ/tissue, appearance of preneoplastic lesions and foci, and the occurrence of tumors. The two tasks that are being pursued this fiscal year are: to evaluate, in the liver of the Japanese Medaka exposed to the carcinogen DEN, the integrity of DNA and the status of the detoxification system (biotransformation capabilities); and to evaluate the kinetics of formation of various liver cell types subsequent to exposure to DEN. 2 refs., 2 figs.

32400 (PB–89-859748/XAB) **Asbestos exposure: health effects. January 1985-April 1989 (Citations from the Biobusiness data base). Report for January 1985-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 82p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the health effects of exposure to asbestos in the workplace, at home, and in public sites. Exposure during procurement of asbestos, removal of asbestos materials, manufacture of materials, and while living and working with materials containing asbestos are considered, as well as analytical techniques used to study asbestos health effects. Mortality patterns and clinical studies of exposure, risk, and resulting diseases are also presented. Asbestos removal and abatement questions and equipment used in these operations are included. (Contains 123 citations fully indexed and including a title list.)

32401 (SNV–3533) **Defoliation of coniferous trees. Assessments 1984-1987.** Andersson, B. National Swedish Environmental Protection Board, Uppsala. 1988. 31p. Order Number DE89766913/JAW. Available from NTIS (US Sales Only), PC A03/MF A01;1.

In order to obtain a basic view of forest health and an opportunity to observe changes, information on visible symptoms of forest damage was collected during 1984-1986 from 13 reference areas established by the Swedish Environmental Monitoring Programme (PMK). In 1987 the observations were simplified by establishing square plots, 30x30 m. The annual occurrence of needle loss on Norway spruce and Scots pine was estimated visually and expressed as percentage of defoliation on the upper parts of the tree-crowns. As the reference areas are situated all over Sweden from Lat. 55 to 69, the climatic factors, such as temperature, winds, drought, humidity and snow cover, vary within a wide range. There are also altitudinal differences - sites are situated from 50 to 720 m above sea level. Two of the northernmost sites, which are also the high altitude ones, had the highest defoliation values. In the south, the most severely defoliated trees were growing on sites near the western and the eastern coasts. Annual variations may be caused by climatic events, e.g. in 1985 some trees were severely defoliated possibly because of local frost incidents. The observed defoliation of conifers does not seem to have a linear relationship with the pollution gradient but is also attributable to natural stress factors. According to cited literature, there is a possibility that deposition of rather low amounts of pollutants cause synergistic reactions with acid mist and ozone. Such effects might contribute to the defoliation. (With 37 refs.)

32402 Fluorescence line narrowing spectrometric analysis of benzo[a]pyrene-DNA adducts formed by one-electron oxidation. Zamzow, D. (Iowa State Univ., Ames (USA)); Jankowiak, R.; Cooper, R.S.; Small, G.J.; Tibbels, S.R.; Cremonesi, P.; Devanesan, P.; Rogan, E.G.; Cavalieri, E.L. *Chemical Research in Toxicology (USA)*, 2(1): 29-34 (Jan-Feb 1989). DOE Contract W-7405-ENG-82.

Fluorescence line narrowing (FLN) was demonstrated for five benzo[a]pyrene (BP)-nucleoside adducts synthesized by one-electron oxidation of BP in the presence of guanosine, deoxyguanosine, and deoxyadenosine. The standard FLN spectra were used to prove that a major depurination adduct from the binding BP to DNA in rat liver nuclei is 7-(benzo[a]pyren-6-yl)guanine (N7Gua). The structural characterization was performed with only 20 pg of the adduct. Metabolic activation of BP by one-electron oxidation in the horseradish peroxidase catalyzed reaction of BP with DNA (in vitro) was also investigated. The major adduct identified was 8-(benzo[a]pyren-6-yl)guanine (C8Gua).

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 32408

32403 (EPRI-EN–6391) **Identification of Ions near HVDC [high-voltage direct-current] transmission lines: Final report.** Eisele, F.L. Electric Power Research Inst., Palo Alto, CA (USA); Georgia Inst. of Tech., Atlanta, GA (USA). Electromagnetics Lab. c May 1989. 70p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Positive and negative ion species were identified and studied at two separate field sites and one laboratory site. The first field study was conducted under an operating HVDC transmission line. The second was near a HVDC test line and measurements were performed with the line in both an energized and de-energized state. During clear, sunny days $HSO_4^- \cdot H_2SO_4$ was observed to be the dominant negative ion in the natural ion spectrum. At night, however, HSO_4^- core ions virtually disappeared, and were replaced by NO_3^- core ions and their first nitric acid cluster. Both negative spectra also typically contained lesser concentrations of the malonate ion. The transmission line negative spectra were similar but were typically dominated by the NO_3^- core ions during both day and night. The positive ions observed under HVDC lines were typically either NH_4^+ or $C_5H_6N^+$, which reacted with higher proton affinity species (such as methylpyridines, trimethylamine and quinoline) farther from or in the absence of the transmission line. The observed differences between natural and anthropogenic ion spectra near HVDC lines are attributed primarily to a shortening of ion lifetimes by the strong electric field associated with the HVDC lines. One exception is the production of potassium and probably sodium based ions from the decomposition of insects in transmission line coronas. 22 refs., 29 figs.

32404 (OH/RD–118-D-393) **The electrical characteristics of wood poles.** MacLeod, D.M. Ontario Hydro Research Div., Toronto, ON (Canada). 1987. 135p. (CE–02594). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NONMEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

This report presents the results of a study of wood pole electrical characteristics from the point of view of potential hazards which might exist with combinations of wood species and treatment types, contact scenarios, and weather conditions. The principal objective of this project was to determine the degree of hazard which might exist when linemen or members of the public come into contact with wood poles during direct HV line contact with the pole, or during conditions where contaminated or damaged insulators are present. A second objective was to determine the feasibility of using the electrical properties of wood poles as diagnostic aids to allow simple and reliable assessments of internal rot. Laboratory and field tests were carried out to develop a realistic wood pole equivalent circuit accounting for wood species, treatment type, and weather conditions. The wood pole model was then integrated with hazard assessments to account for the type of contact between man and pole, the type of current source and accepted hazard thresholds. An assessment was undertaken to determine whether or not the electrical properties of poles can be used as diagnostic aids. Five pole species and four treatment types, including untreated poles were evaluated. The results of these studies identified the hazards associated with typical contact scenarios, representative insulator conditions, and species and treatment types. 43 refs., 29 figs., 22 tabs.

32405 (PB–89-165047/XAB) **Occupational safety and health effects of high-voltage transmission lines.** Witwer, C.R.; Kaplan, S.D.; Scott-Walton, B.L.; Krebs, J.S.; Young, J.R. SRI International, Menlo Park, CA (USA). Center for Occupational and Environmental Safety and Health. Nov 1978. 73p. Available from NTIS, PC A04/MF A01.

The potential health hazards associated with the installation, maintenance, and operation of high-voltage transmission lines were reviewed. Specific hazards considered included exposure to ozone, audible noise, electric shock, and high-intensity electromagnetic fields. Experiments were conducted to simulate the worst possible conditions. Under these conditions the exposure of the workers to ozone was quite substantial. Direct measurement of these exposures should be made on the job. While the exposure to noise levels was lower than minimum levels estimated to cause hearing loss, noise on the line may make it difficult to hear the words of fellow workers which could present a hazardous situation if a spoken warning is not heard. Although no evidence exists to suggest hazards arising from exposure to electromagnetic fields, the tests thus far have considered fields weaker than peak occupational exposures. The authors recommend that actual field measurements be taken. Harmful effects of exposures to electric shock would include respiratory arrest, ventricular fibrillation, and burns.

32406 (PB–89-165286/XAB) **Questions and answers about biological effects and potential hazards of radiofrequency radiation (third edition).** Federal Communications Commission, Washington, DC (USA). Office of Engineering and Technology. Jan 1989. 21p. (OET/BULL–56). Available from NTIS, PC A03/MF A01.

See also PB–85-120848.

The Federal Communications Commission (FCC) is responsible for licensing or authorizing many of the transmitting devices in the United States that use radio-frequency (RF) radiation to provide a variety of important telecommunications services. Because of its responsibilities in this regard, the FCC often receives inquiries concerning potential health risks from exposure to the RF radiation emitted by these transmitters. The expanding use of RF technology has resulted in speculation concerning the alleged 'electromagnetic pollution' of the environment and the potential dangers of exposure to non-ionizing radiation. The publication is written in a question and answer format and is designed to provide factual information to the public by answering some of the most commonly asked questions about this complex and often misunderstood topic. Information is included on such topics as the differences between non-ionizing and ionizing radiation; the biological effects of RF energy; health and safety standards; federal responsibilities; and RF exposure from specific types of transmitters. The bulletin is an updated version of the previous (second) edition published in 1983.

32407 (PB–89-860019/XAB) **Nonionizing electromagnetic radiation: biological effects. January 1972-April 1989 (Citations from the International Aerospace Abstracts data base). Report for January 1972-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 128p. Available from NTISPC N01/MF N01.

Supersedes PB–88-859723; U.S. sales only.

This bibliography contains citations concerning the biological effects of non-ionizing electromagnetic radiation. Energy absorption and radiation effects to humans, animals, and insects are discussed. Theoretical and experimental dosimetry are considered. Safety standards are included. (This updated bibliography contains 268 citations, 17 of which are new entries to the previous edition.)

57 HEALTH AND SAFETY

32408 (CEA/RD–ST272SR) **Epidemiological studies relating human health to electric and magnetic fields. Criteria for evaluation.** Canadian Electrical Association, Montreal, PQ (Canada). 1988. 103p. (CE–02606). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The International Electric Research Exchange (IERE) created a working group in 1985 to identify relevant studies on the effects of electric and magnetic fields (EMF); this report is about the findings of the working group. Criteria are developed to judge the soundness and informational value of individual epidemiological studies. These criteria are applied to a review of all 17 published studies, which were divided into two subgroups: all childhood cancers and adult leukemia. The evidence supporting causality of EMF in both adult leukemias, and childhood cancers, is weak, but warrants further study, particularly in populations where the EMF exposures can be well characterized. It is further recommended that IERE foster basic research into the effects of EMF and improved exposure assessment methods. 51 refs., 1 fig., 6 tabs.

32409 (ORNL/TM–11081) **Free-ranging dogs and cats on the Oak Ridge Reservation: Situation and solution.** Greenberg, C.H. Oak Ridge National Lab., TN (USA). Apr 1989. 15p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89012931/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The free-ranging cat and dog population on the Oak Ridge Reservation (ORR) was evaluated because of concern about the possibility of attacks on humans, the transmittal of disease, the impact on native ORR wildlife, and nuisance problems. Intensive trapping, scent-line transects, surveys of employee opinion at Martin Marietta Energy Systems, Inc., and reports of free-ranging dog and cat sightings revealed that (1) the greatest population concentration is near major roads and buildings; (2) no incidents involving attacks or disease transmission to humans were reported (although harassment of humans by dogs was reported); (3) most Energy Systems employees regard the free-ranging dog and cat population as a nuisance problem, and only 8.1% regard the situation as severe. Recommendations to reduce this problem include: make attractive sites (sanitary landfills) inaccessible; repair exclosures along the ORR boundary; inform pet owners of and enforce laws regarding free-ranging pets; and create a system for reporting sightings and incidents and designate a person(s) to be responsible for responding to such reports. 31 refs., 3 figs., 5 tabs.

32410 (PB–89-164859/XAB) **Safety evaluation of a prototype hydride-powered underground-mining vehicle. Final report, May 1984-May 1987.** Lynch, F.; Olavson, L.; Baker, N. Eimco Mining Machinery International, Salt Lake City, UT (USA). 15 May 1987. 129p. (REPT–7405-5). Available from NTIS, PC A07/MF A01.

This study assesses the reliability, operability, and safety of a prototype underground-mining utility vehicle fueled by hydrogen stored in a hydride-fuel system. The assessment is based on data derived from (1) a severe offroad vehicle operational test, (2) simulated accidental hydrogen-release tests, (3) a Fault Tree Analysis and (4) a hazards and operability study (HAZOP). The study was limited to the vehicle proper, and did not include underground refueling. On that basis it is concluded that no fundamental safety problems exist with respect to the vehicle and vehicle systems that would discourage the use of this type of mining vehicle.

32411 (PB–89-860167/XAB) **Carbon monoxide sensors. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989.** National Technical Information Service, Springfield, VA (USA). Apr 1989. 67p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the measurement and sensing of carbon monoxide. Carbon monoxide sensors used to prevent asphyxiation, combustion, and explosion are discussed. Carbon monoxide sensors used to measure combustion efficiency and gas levels in the atmosphere are included. Designs for gas sensors that measure several gases or carbon monoxide alone are presented. Extraterrestrial applications of carbon monoxide sensors are excluded. (Contains 140 citations fully indexed and including a title list.)

58 GEOSCIENCES

32412 (CBPF-NF–041/88) **Geochronology and geochemistry by nuclear tracks method: some utilization examples in geologic applied.** Poupeau, G.; Soliani Junior, E. Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ (Brazil). 1988. 26p. (In Portuguese). Order Number DE89613060/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This article discuss some applications of the 'nuclear tracks method' in geochronology, geochemistry and geophysic. In geochronology, after rapid presentation of the dating principles by 'Fission Track' and the kinds of geological events mensurable by this method, is showed some application in metallogeny and in petroleum geology. In geochemistry the 'fission tracks' method utilizations are related with mining prospecting and uranium prospecting. In geophysics an important application is the earthquake prevision, through the Ra/sup 222/emanations continous control.

5801 Geology and Hydrology

Refer also to citation(s) 30579, 32058, 32069, 32433

32413 (EMR–M44-88/22E) **Holocene proxy-climate data from the Canadian Arctic.** Ovenden, L. Department of Energy, Mines and Resources, Ottawa, ON (Canada). 1988. 15p. (MICROLOG–89-01812). Available from Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, Canada K1A 0S9; $5.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

A review of diverse reports of the Geological Survey of Canada has produced lists of radiocarbon-dated samples from the Canadian Arctic which indicate four climatically significant occurrences during the Holocene: vascular plant range extensions, peat deposits of Arctic islands, eolian deposition, and thermokarst and thaw. These data suggest warmer and perhaps wetter summers in the western Arctic during the early Holocene and warmer and/or wetter summers during the mid-Holocene elswhere in the Canadian Arctic. This interpretation is limited by gaps in the database and by uncertainty about the relationship of each data type to climate. The data are consistent with paleoclimatic interpretations of the low Arctic which are based primarily on pollen studies. 63 refs., 1 figs., 4 tabs.

32414 (INIS-BR–1501) **Magmatic and petrologic evolution of the mesozvic vulcanic acid rocks from Piraju-Ourinhos region (SP-PR).** Raposo, M.I.B. Sao Paulo Univ., SP (Brazil). Inst. Astronomico e Geofisico. 1987. 169p. (In Portuguese). Order Number DE89613065/JAW. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

This work presents the result of geological, petrological and geochemical studies, on the volcanic rocks from Piraju-Ourinhos region, SP, with special emphasis on the rocks. A geological mapping was carried out by using images from Landsat satellite. Petrographic and chemical analyses have defined a suite represented by basic lithotype - tholeutic andesibasalt - with high TiO/sub 2/, rich in incompable elements - mainly Sr, Zr, La, Ce, and Ba - and by acid lithotype - rhyolite - rhyodacite. k-Ar ages are determined in feldspar concentrated, and indicate an age of 133± 4m,y, for the volcanic acid rocks. Determinations of Sr isotopes. In order to explain the genesis of Chapeco type acid magnas quantitative models were tested using both fractional Crystallization.

32415 (INIS-BR–1503) **Geology and Geochemistry of the Poco de Fora region-Curaca river valley-Bahia-Brazil.** Figueiredo, M.C.H. de. Bahia Univ., Salvador (Brazil). Inst. de Geociencias. 1976. 95p. (In Portuguese). Order Number DE89613067/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

In the Poco de Fora region level rocks of light metamorphism, from Caraiba group, corresponding to: - a meta-sedimentar sequence from Lower Pre-cambrian (Archean) - maphic-ultramaphic bodies with Fe and Cu sulphides of volcanogenic origin, and - sienitic ortho-gneiss. Geological, petrographic, geochemistry and geochronological studies were done. The sienitic-intrusion, from the upper crust, occur during the Archean-beginning of the Proterozoic. All the region was re-mobilized, and the sienitic was metamorphosed during Transamazonic Orogeny (2.200 to 1.800 m.y.). (C.D.G.).

32416 (INIS-BR–1514) **Pre-cambrian geochronology in Rio Grande do Norte, Brazil.** Galindo, A.C. Rio Grande do Norte Univ., Natal (Brazil). Aug 1981. 17p. (In Portuguese). Order Number DE89613068/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The Precambrian region polyciclic caracter, in the Rio Grande do Norte State has make difficulties to its geochronological and geological studies. Four importants tectonometamorphic occurences identified dissimulate the original isotopic composition of the rocks. Is much defined the presence of three geochronological events wich left vestiges in the differents Serido litological units. The first event is related with Jequie cicle (2,7 b.y) and related with the Caico Group rocks. The second important event define the Transamazonic cicle (2.1 b.y). The third is correlated with Brazilian Cicle, when occurred the granitoids and pegmatites bodies formation. This third event was the last in this region and affect the other units too. (C.D.G.).

32417 (LBL–25586) **Lithologic composition and variability of the sediments underlying Kesterson Reservoir as interpreted from shallow cores.** Flexser, S. Lawrence Berkeley Lab., CA (USA). Jul 1988. 37p. DOE Contract AC03-76SF00098. Order Number DE89013354/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Shallow cores at Kesterson Reservoir demonstrate two generalized lithologic units: a lower unit composed mainly of well sorted sands and gravels deposited on the San Joaquin River floodbasin, and an upper unit containing abundant clay-rich and poorly sorted sediments deposited in marshes similar to the modern environment. The boundary between the upper and lower units is generally gradational, and occurs at different elevations at different sizes. The two units are similar mineralogically, their detrital components primarily Sierran granitic in origin; the upper unit, however, is generally more weathered and oxidized than the lower. At one location, the presence of distinctive mudflow deposits indicates one or more recent incursions of the Coast Range alluvial fan into this part of the Central Valley. Relict soils are observed in both the upper and lower units. However, a high degree of lateral discontinuity characterizes both units, and few of these soils, and few strata or sub-units of any type, can be traced between individual cores. In the lower unit, discontinuity is related to normal fluvial processes of channel migration and incision operating in the depositional environment. In the upper unit, the irregular, ponded topography of the marsh environment may be the main source of discontinuity. A radiocarbon date of approximately 26,000 yr B.P. suggests that the coarse grained sediments near the base of the lower unit were probably deposited near the start of the last (Tioga) period of Sierran glaciation. 7 refs., 22 figs.

5802 Geophysics

Refer also to citation(s) 30609, 30878, 31609

32418 (BARC–1429) **Research and development activities of the seismology section for the period January 1986 to December 1987.** Basu, T.K.; Murty, G.S. (eds.) (Bhabha Atomic Research Centre, Bombay (India). Seismology Section). Bhabha

Atomic Research Centre, Bombay (India). 1988. 130p. Order Number DE89613512/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

This report sumarises the R and D in Seismology during the period from January 1986 to December 1987. Major topics of current study are (1) Forensic Seismology, (2) Seismicity and Seismic Risk estimates, (3) Reservoir induced seismicity and (4) Rockburst monitoring. Considerable effort is devoted to development of seismic data acquisition systems and theoretical aspects of seismology.

32419 (CONF-8905127–4) **High resolution subsurface imaging with geophysical diffraction tomography.** King, W.C.; Witten, A.J. Oak Ridge National Lab., TN (USA). 1989. 15p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. From 3. National Water Well Association outdoor action conference; Orlando, Florida, USA; 22-25 May 1989. Order Number DE89013615/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes the evolution of a promising new technique for subsurface remote sensing, geophysical diffraction tomography, from its theoretical formalism to its current state as a proven field technique capable of high resolution imaging of natural and buried subsurface features. The paper begins with a brief introduction of the concept of diffraction tomography and a review of the theoretical development of a scheme for implementing diffraction tomography in a geophysical imaging technique. Next, the field procedure is described. The final topic for this paper, and its primary objective, is to present results of three recent field tests of the system. 9 refs., 12 figs.

32420 (IC–88/423) **Geologic considerations for urban planning in seismic environment.** Agrawal, R.C. International Centre for Theoretical Physics, Trieste (Italy). Dec 1988. 9p. Order Number DE89613513/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Even though it is desirable to visualize the performance of an entire metropolitan centre during earthquake occurrences as part of local hazards mitigation programme, yet these centres still remain vulnerable to major seismic activity. Geological considerations lack in urban planning and do not account for hazards mitigation. This may also be due to the involvement of several interdependent activities, like services, functions, life line elements, etc. The failure of any one of these can make the entire metropolitan area inoperative. It is recommended that multidisciplinary teams should undertake zoning studies for use in the future growth areas of Indian urban centres. (author). 5 refs, 1 fig., 2 tabs.

32421 (SKB-TR–88-23) **Source parameters of major earthquakes near Kiruna, Northern Sweden, deduced from synthetic seismogram computation.** Kim, W.Y.; Skordas, E.; Zhou, Y.P.; Kulhanek, O. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jun 1988. 53p. Order Number DE89613520/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The earthquakes that have occurred around Kiruna in northern Sweden have been studied in detail in order to determine their source characteristics and to understand the pattern of seismic acticity in the region. All earthquakes with magnitude greater than 3.0 (M/sub L/) that occurred during the period between 1967 and 1985 in the region bounded by 66.5 degrees - 69 degrees N and 19 degrees - 25 degrees E are studied. Relocated epicenters of the events exhibit a cluster of events in a direction NE - SW at at the western side of the region close to Kiruna, Though, the focal depths of the events are not very well constrained, the relocation results suggest that the events in this cluster might have occurred at focal depths between 15 and 25 km. At the easstern side of the region, the epicenters are roughly aligned along an elongated area trending NNW - SSE. The focal depths of the events in this area tend to be shallow and are probably in the upper crust at the depths range from 5 to 16 km. The earthquakes studied show nearly constant source radii of about 0.4 - 0.6 km over the seismic moment range 10/sup 20/to 10/sup 21/dyne-cm. Consequently, the events studied are characterized by a steadily incresing stress drop relative to increasing seismic moment. The source mechanisms obtained for the two largest earthquakes suggest that the mechanisms are dominated by the normal faultings on the near-vertical fault planes trending N - S to NE - SW. (With 26 refs.) (authors).

32422 (TAU–8704-1) **Determining geotechnical and hydrogeological parameters using downhole geophysics in the Canadian plains. Phase 1 report. A review of potential applications, vol. 1.** TransAlta Utilities Corp., Calgary, AB (Canada). 1987. 102p. (MICROLOG–89-01733). Available from Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Current state of the art and published literature concerning the use of downhole geophysics to obtain various parameters for both coal and oil sand mining operations are reviewed. Three main classes of geophysical instrumentation and four other measurement systems were identified, including electrical, nuclear, acoustic, caliper, temperature, flow, and image based systems. In the review of potential geotechnical applications, it is apparent that several of the desired parameters can be determined from currently available geophysical logging and interpretation techniques. These include use of dipmeter logs for structural interpretation; acoustic methods to provide information on rock properties; and use of radar for providing structural information between boreholes. The review of potential hydrogeological applications reveals that the petroleum industry is well advanced in this area, such as the determination of porosity from neutron logs. Flowmeters and temperature probes are reported to be able to provide information on the distribution of permeability within the borehole and the location of aquifers. Water quality determinations have been made through correlation of total dissolved solids and water resistivity. Current research into geophysical instrumentation and methods reveals a large number of groups working in this field. There is an overall conclusion that techniques are available to determine some of the parameters of interest. However, the reliability and effectiveness of these techniques in the shallow, soft rock typical of western Canadian coal and oil sand mining situations has not been fully evaluated or in some cases even attempted. 67 refs., 2 figs., 3 tabs.

32423 (UCRL–98720) **An evaluation of cross-borehole resistivity tomography.** Daily, W.; Yorkey, T.J. Lawrence Livermore National Lab., CA (USA). May 1988. 11p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-881018–2: 58. Society of Exploration Geophysicists annual meeting, Anaheim, California, USA, 30 Oct - 3 nov 1988). Order Number DE89011406/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, model calculations evaluate the usefulness of tomographic image reconstruction from cross-borehole resistivity measurements. The model has two resistive layers with a conductive anomaly imbedded in the lower layer. We calculated the potential distributions along the borehole resulting from a dipole current source located at various places in each borehole. From these data a resistivity map (tomograph) is constructed. For many different cases these tomographs were good representations of both spatial distribution and magnitude of the model resistivity. 6 refs., 4 figs.

32424 Properties of earthquakes generated by fault dynamics. Carlson, J. M. (Institute for Theoretical Physics, University of California, Santa Barbara, California 93106(US)); Langer, J. S. *Physical Review Letters (USA),* 62(22): 2632-2635 (29 May 1989).

We present a model for fault dynamics consisting of a uniform chain of blocks and springs pulled slowly across a rough surface. The only nonlinear element of our model is a slip-stick friction force between the blocks and the surface. We find that this model gives rise to events of all sizes. Our numerical evaluation of the distribution of earthquake magnitudes results in power-law spectrum similar to what is observed in nature. Like certain other dissipative dynamical systems, the observed large fluctuations in earthquake magnitude persist because the system is in a state of marginal stability.

32425 Volcanic centers of southwestern Nevada: Evolution of understanding, 1960–1988. Byers, F. M., Jr. (Los Alamos National Laboratory, New Mexico(US)); Carr, W. J.; Orkild, P. P. *Journal of Geophysical Research (USA),* 94(B5): 5908-5924 (10 May 1989).

Since about 1960, geologists of the U.S. Geological Survey and, morerecently, those of Los Alamos and Lawrence Livermore national laboratories,supported largely by the U.S. Department of Energy (DOE) and its predecessors,have been unraveling a complex series of ash flow sheets, lavas, and relatedcalderas in the southwestern Nevada volcanic field in and near the Nevada TestSite (NTS). Extensive detailed geologic mapping aided in delineation offour major calderas: Silent Canyon (~14 Ma), Timber Mountain–OasisValley (~11.5 Ma), Black Mountain (~7.5 Ma), and Stonewall Mountain(~6 Ma). In the 1960s, key concepts that contributed to the understandingof volcanology were the recognition of vertical compositional zonation withinash flow sheets, the significance of caldera rim and moat lavas, therelation between caldera collapse and intracaldera breccias and ash flow facies,and the correlation of intracaldera and outflow-sheet facies. Deep drill holeswithin Silent canyon and Timber Mountain caldera provided vital informationon caldera geometry and intracaldera facies. Radiometric dating has producednearly 100 dates that define the age of the field between about 16 and 6 Ma.

32426 Evidence for dynamic withdrawal from a layered magma body: The Topopah Spring Tuff, southwestern Nevada. Schuraytz, B. C. (Department of Geological Sciences, Michigan State University, East Lansing(US)); Vogel, T. A.; Younker, L. W. *Journal of Geophysical Research (USA),* 94(B5): 5925-5942 (10 May 1989).

The Topopah Spring Tuff is a classic example of a compositionallyzoned ash flow sheet resulting from eruption of a compositionally zoned magmabody. Geochemical and petrographic analyses of whole rock tuff samplesindicate that the base of the ash flow sheet and the predominant volumeof erupted material consist of crystal-poor high-silica rhyolite, with agradational transition into overlying crystal-rich quartz latite.However, major and trace element analyses of glassy pumice lumps andmicroprobe analyses of their silicate and oxide phenocrysts provide closerapproximations of the chemical and thermal gradients within the magma body.The gradients inferred from these data indicate that the transition fromhigh-silica rhyolitic to quartz latitic magma within the chamber was abrupt,rather than gradational, with a distinct liquid-liquid interface separating thecontrasting magma layers. Compositionally and texturally distinct pumice lumpsare present throughout the ash flow sheet. The degree of heterogeneity withinand among pumice lumps increases with stratigraphic height, becoming mostpronounced in the uppermost quartz latite, where the chemical variabilityamong pumice lumps is as great as that of the entire ash flow sheet. Theseobservations are consistent with fluid dynamic models in which the velocityfield developed near the entrance region of the vent(s) results insimultaneous withdrawal of magma from all points of a continuouslyexpanding lateral and vertical region within the chamber. The abrupttransition to chemically bimodal pumice types near the top of the ash flowsheet, dominated by those of quartz latitic composition, implies that theinterface between the magma layers remained relatively stable until drawdownbreached the interface and preferentially erupted hotter, more mafic magmaalong with lesser amounts of remaining high-silica rhyolitic magma.

32427 Chemical and mineralogic trends within the Timber Mountain–Oasis Valley caldera complex, Nevada: Evidence for Multiple cycles of chemical evolution in a long-lived silicic magma system. Broxton, D. E. (Los Alamos National Laboratory, Los Alamos, New Mexico(US)); Warren, R. G.; Byers, F. M.; Scott, R. B. *Journal of Geophysical Research (USA),* 94(B5): 5961-5986 (10 May 1989).

Rocks of the Miocene and Pliocene Timber Mountain–Oasis Valley(TM-OV) caldera complex in the southwest Nevada volcanic field are dominantlyrhyolites and quartz latites (trachytes). Minor basalticto dacitic rocks were erupted peripherally to the caldera complex and in themoat of the youngest caldera. We divided the petrologic evolution of thecaldera complex into a series of petrochemicalcycles based on systematic changes in rock chemistry, modal petrography, andmineral chemistry as a function of time. Each petrochemical cycle ischaracterized by periods of systematic differentitiation toward more siliceousor rhyolitic compositions. Breaks between cycles are generally abrupt andfollow either times of major ash flow tuff eruption or episodes of relativelymafic (basaltic to dacitic) volcanism.

32428 Phenocryst abundances and glass and phenocryst compositions as indicators of magmatic environments of large-volume ash flow sheets in southwestern Nevada. Warren, R. G. (Los Alamos National Laboratory, Los Alamos, New Mexico(US)); Byers, F. M., Jr.; Broxton, D. E.; Freeman, S. H.; Hagan, R. C. *Journal of Geophysical Research (USA),* 94(B5): 5987-6020 (10 May 1989).

The Topopah Spring, Tiva Canyon, Rainier Mesa, and Ammonia Tanks tuffsare large-volume, silicic ash flow sheets that provide samples of fourmagmatic systems in southwestern Nevada. Successively erupted within a span of2 m.y. from the same source area, they allow comparison of the sequentialevolution of large-volume, mature Cordilleran magmatic systems. Each largesheet has a rhyolitic lower zone and quartz latitic upper zone. Coevalbasaltic andesite and basalt show petrochemical continuity with these sheetsand may represent mantle contributions that triggered eruptions of themidcrustal silicic portion. Abundance of phenocrysts and accessory phasesincrease upward with whole rock Fe (FeOt) from the base of all four sheets tomaximum values unique for each system. Although maximum abundances of eachmineral are unique for each sheet, each maximum occupies the same relativeposition within each sheet. High-temperature minerals such as plagioclaseincrease in abundance continuously with FeOt in each system, showing a decreasewith FeOt only within basaltic andesite at the base of the Rainier Mesasystem. Late crystallizing minerals such as quartz and sphene show maximumabundances at much lower FeOt, at or near the top of the rhyolitic zone.Minerals that normally form at intermediate stages of crystallization, such assanidine, show maxima at intermediate FeOt for each sheet. A continuum ofglass and phenocryst compositions occurs within the Topopah Spring andRainier Mesa sheets. Variations in phenocryst compositions with FeOt aregenerally consistent with those expected for crystallization within magmareservoirs characterized by vertical thermal and compositional gradients.However, simple fractional crystallization does not adequately explain theclose relationship in each sheet among the mineral chemistry, glass (magma)chemistry, and phase assemblages, which indicate a close approach to equilibriumwithin each magma system.

5803 Mineralogy, Petrology, and Rock Mechanics

Refer also to citation(s) 31322

32429 (DP-MS–88-251) **State of stress and the relation to tectonics in the central Savannah River area of South Carolina.** Zoback, M.D.; Moos, D.; Stephenson, D.E. Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant. 1989. 23p. Sponsored by DOE Defense Programs. DOE Contract AC09-76SR00001. (CONF-890628–11: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89010450/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An element of the seismic hazard assessment program at the Savannah River Plant (SRP), South Carolina, was the measurement of the in situ state-of-stress existing in the crystalline basement rock below the site. Hydraulic fracturing stress and related geophysical measurements including borehole televiewer logs were performed in a series of wells at various locations on the SRP site. Prior to the start of the field program, scoping studies using laboratory measured rock properties and the estimated regional stresses in a boundary element program were performed to predict if wellbore breakouts would occur in the borings depth. At the depths of the wells, the laboratory strength of the rock was great enough to prevent failure unless the in situ stresses were very high. The in situ stress field measured at the site is similar to that found at comparable depths in the region, where $S_H > S_h > S_v$ and the maximum horizontal stress is oriented NE-SW. The measured stress state indicated high horizontal stresses that could cause reverse faulting on favorably oriented pre-existing planes of weakness. This reverse faulting is consistent with the observed structure of the basement rock on site. 22 refs., 5 figs., 2 tabs.

32430 (INIS-BR-1513) **X-ray diffraction identification of clay minerals by microcomputer.** Rodrigues, S.; Imasava, F.J. Associacao Brasileira de Ceramica, Sao Paulo, SP (Brazil). 1988. 16p. (In Portuguese). (CONF-8804217-: 32. Brazilian congress on ceramics, Natal, Brazil, 24-27 Apr 1988). Order Number DE89614731/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The identification of clay minerals by X-ray powder diffraction are done by searching an unknown pattern with a file of standard X-ray diffraction patterns. For this searching done by hand is necessary a long time. This paper shows a program in "Basic" language to be utilized in microcomputers for the math of the unknown pattern, using the high velocity of comparison of the microcomputer. A few minutes are used for the match.

32431 (LA-UR-89-1793) **Characterization of lunar ilmenite resources.** Heiken, G.; Vaniman, D.T. Los Alamos National Lab., NM (USA). 1989. 30p. Sponsored by National Aeronautics & Space Administration. DOE Contract W-7405-ENG-36. (CONF-8903111-3: Lunar planetary science conference, Houston, Texas, USA, 12-18 Mar 1989). Order Number DE89013455/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ilmenite will be an important lunar resource, to be used mainly for oxygen production but also as a source of iron. Ilmenite abundances in high-Ti basaltic lavas are higher (10–20%) than in high-Ti mare soils (mostly <10%). This factor alone may make crushed high-Ti basaltic lavas most attractive as a target for ilmenite extraction. Concentration of ilmenite from either a crushed basalt or regolith requires sizing to avoid polycrystalline fragments. In coarse-grained high-Ti basaltic lavas, about 60–80% of the ilmenite will consist of relatively "clean" single crystals if the rocks are crushed to a size of 0.2 mm. Fine-grained high-Ti basalts, with thin skeletal or hopper-shaped ilmenites, would produce essentially no free or "clean" ilmenite grains unless crushed to sizes of less than 0.15 mm, and only ~7% free ilmenite if crushed to sizes smaller than 0.05 mm. Data from the 2.8 m-thick regolith sampled by coring at the Apollo 17 site show that in even the most basalt-clast-rich and least mature stratigraphic intervals, free ilmenite grains make up less than 2% of the 0.02- to 0.2-mm size fraction and a mere 0.3% of the 0.2- to 2-mm size fraction. 23 refs., 9 figs., 1 tab.

32432 (LBL-26595) **Stress induced microcrack geometry at failure in unconfined and confined axial compressive tests.** Zheng, Z.; Myer, L.R.; Cook, N.G.W. Lawrence Berkeley Lab., CA (USA). Jan 1989. 8p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890628-9: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89009058/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Cylindrical specimens of Indiana limestone have been tested in uniaxial, confined and partially confined compression. A low melting point metal alloy was used as a pore fluid. At the stress of interest this alloy was solidified in place to preserve the stress induced microcracks. Optical and electron micrographs of cross sections from the specimens were used to study the density, orientation, thickness and mechanism of these microcracks as a function of confinement.

32433 (LBL-26868) **Characterization of fracture networks for fluid flow analysis.** Long, J.C.S.; Billaux, D.; Hestir, K.; Majer, E.L.; Peterson, J.; Karasaki, K.; Nihei, K.; Gentier, S.; Cox, L. Lawrence Berkeley Lab., CA (USA). Jun 1989. 23p. Sponsored by DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. (CONF-8806169-3: 4. annual Canadian/American conference on hydrogeology, Banff, Canada, 22-24 Jun 1988). Order Number DE89013423/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The analysis of fluid flow through fractured rocks is difficult because the only way to assign hydraulic parameters to fractures is to perform hydraulic tests. However, the interpretation of such tests, or "inversion" of the data, requires at least that we know the geometric pattern formed by the fractures. Combining a statistical approach with geophysical data may be extremely helpful in defining the fracture geometry. Cross-hole geophysics, either seismic or radar, can provide tomograms which are pixel maps of the velocity or attenuation anomalies in the rock. These anomalies are often due to fracture zones. Therefore, tomograms can be used to identify fracture zones and provide information about the structure within the fracture zones. This structural information can be used as the basis for simulating the degree of fracturing within the zones. Well tests can then be used to further refine the model. Because the fracture network is only partially connected, the resulting geometry of the flow paths may have fractal properties. We are studying the behavior of well tests under such geometry. Through understanding of this behavior, it may be possible to use inverse techniques to refine the a priori assignment of fractures and their conductances such that we obtain the best fit to a series of well test results simultaneously. The methodology described here is under development and currently being applied to several field sites. 4 refs., 14 figs.

32434 (SAND-88-2943C) **Acoustic emissions during anelastic strain recovery of cores from deep boreholes.** Teufel, L.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 8p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890628-5: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89005919/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Acoustic emissions and compressional wave velocity measurements were monitored during anelastic strain recovery measurements on sandstone, siltstone, and chalk cores, immediately after the cores were retrieved from 2.7 to 3.2 km deep boreholes. Strain recovery occurred in all of the cores and acoustic emissions were always detected during recovery. The acoustic emission rate decreased exponentially with time, similar to the strain relaxation behavior of the cores, and acoustic emission activity ceased when strain relaxation no longer occurred. The cumulative number of acoustic emission events was linear with volume expansion of the cores. No significant decrease in velocity occurred during strain relaxation, monitored 6–52 hours after the cores were cut, because the strains were small (less than 300 microstrains). However, laboratory measurements of compressional velocity on relaxed, air dried cores show a well-defined anisotropy in low porosity cores, which had a strong preferred orientation of the principal recovery strains. The slowest velocity was in the direction of maximum expansion. The field and laboratory results suggest that a statistically aligned microcrack population evolves during strain relaxation, with microcracks opening more in the direction of maximum strain recovery. It is proposed that the degree of anisotropy is dependent on the relative difference in the magnitude of the in situ principal stresses and corresponding strain relaxation, as well as the degree of heterogeneity of the rock. In high porosity rocks, the fractional increase in porosity due to relaxation microcracks is much smaller. Therefore, differential expansion of a core, due to opening of relaxation microcracks with preferred orientations, does not produce a measurable anisotropy. 16 refs., 3 figs.

32435 (UCRL-99662) **Laboratory observations of the effect of geological discontinuities on hydrofracture propagation.** Blair, S.C.; Thorpe, R.K.; Heuze, F.E.; Shaffer, R.J. Lawrence Livermore National Lab., CA (USA). Jan 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890628-6: 30. US symposium on rock mechanics, Morgantown, West Virginia, USA, 19-22 Jun 1989). Order Number DE89006736/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have performed a series of laboratory tests to study the propagation of a hydrofracture into and through an interface between two rock-like materials. Test specimens were prepared by embedding sandstone tablets (lenses) in blocks of gypsum cement. These blocks were hydrofractured under true triaxial loading conditions, at a constant fluid injection rate. The injection path and applied state of stress were designed so that we obtained a single-wing fracture, propagating in a place perpendicular to the interface. Fracture growth was tracked via extension failure of fine tungsten wires embedded in the gypsum. After testing, the blocks were dissected and the extent of fracturing and fluids leakoff were recorded. In each test, the hydrofracture propagated into and through the discontinuity. Pressure-time and fracture tracking data were consistent for all tests. Distinct step increases on the pressure-time record were also noted in all tests, and are related to the interaction of the hydrofracture with the sandstone lens. All the fracture showed step-crack behavior upon entering or exiting the sandstone tablet. In addition,

a finite element model was used to simulate the experiments. Pressure-time records from the model and the experiments compare favorably. 8 refs., 9 figs.

32436 **Oxygen diffusion in olivine: Effect of oxygen fugacity and implications for creep.** Ryerson, F. J. (Lawrence Livermore National Laboratory, University of California, Livermore(US)); Durham, W. B.; Cherniak, D. J.; Lanford, W. A. *Journal of Geophysical Research (USA)*, 94(B4): 4105-4118 (10 Apr 1989).

Oxygen self-diffusion experiments on single crystals of San Carlosolivine (~Fo_{92}) at 1200°≤T≤1400 °C, oxygen fugacities(f_{O2}) along the Ni-NiO and Fe-FeO buffers, and silica activityat the olivine-orthopyroxene buffer yielded results that follow therelationship D=2.6×10^{-10}$f_{O2}^{0.21\pm0.03}$ exp [−266±11](kJ mol^{-1}/RT), where$D$ is the diffusion coefficient in m^2 s^{-1} and f_{O2} is givenin pascals. The activation energy compares reasonably well with results forpure forsterite. The positive dependence of f_{O_2} implies that theoxygen defect responsible for diffusion is an interstitial rather than a morestericaly reasonable oxygen vacancy. Diffusion of oxygen in other close-packedoxides has also shown a positive dependence on f_{O2}. The rate ofcreep of single-crystal olivine at fixed orthopyroxene activity also showsa positive f_{O2} dependence. If oxygen interstitials should be shown tobe unimportant in oxygen diffusion in oxides, then coupled mechanisms such ascountervacancy diffusion must be appealed to in order to explain the positivef_{O2} dependence. Such processes are rate-limited by the diffusion ofmetal vacancies which also display a positive f_{O2} dependence inolivine. Compared with data for silicon diffusion in forsterite, our dataindicate that oxygen is not the slowest diffusing species in olivine.

32437 **Electrical conduction in olivine.** Schock, R. N. (Energy Program, University of California, Lawrence Livermore National Laboratory, Livermore(US)); Duba, A. G.; Shankland, T. J. *Journal of Geophysical Research (USA)*, 94(B5): 5829-5839 (10 May 1989).

This paper reports detailed measurements of electrical conductivityσ and thermoelectric effect S in the mineral olivine and in syntheticforsterite as functions of temperature in the range from 1000° to1500 °C and oxygen partial pressure in the range from 10^{-10} to10^4 Pa. The two most striking observations are strong conductivityanisotropy in forsterite and a sign change in S in olivine at 1390 °C.These results are interpreted to show that both materials have mixed ionic andextrinsic electronic conduction under these conditions. On the basis ofthese interpretations, we infer that forsterite conductivity is dominatedby electronic conduction in the *a* and *b* directions and probably bymovement involving magnesium vacancies in the *c* direction, wherefar higher P_{O_2}-independent conductivity is observed. Olivineappears to show mixed conduction under all the circumstances observed;at low temperature, electron holes dominate but are superseded bymagnesium vacancies at high temperatures.© American Geophysical Union 1989

5804 Geochemistry

Refer also to citation(s) 31577

5805 Oceanography

Refer also to citation(s) 30578

32438 (DOE/ER/60336–5) **Primary production, nutrients, and particulate matter in the southern California bight: Contributions to the C, N, and O_2 budgets: A component of the California Basin Study (CaBS): [Progress report, November 1988].** Eppley, R.W. California Univ., San Diego, La Jolla, CA (USA). Inst. of Marine Resources. 1988. 13p. Sponsored by DOE Energy Research. DOE Contract FG05-85ER60336. Order Number DE89005048/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A carbon budget has been developed for the euphotic zone in the surface waters of the Santa Monica Basin off Los Angeles, California, by CaBS. This grant provided several components of the budget: primary production, new production (equivalent to the sinking flux of biogenic particles out of the euphotic zone), standing stocks of particulate matter including particulate organic carbon, nitrogen and chlorophyll. Ancillary measurements of plant nutrients (nitrate, phosphate, silicic acid) were also made relative to primary and new production rates. The residence time of particulate matter in the euphotic zone was also determined as this is important for removal of particle-reactive substances, such as certain metals, hydrocarbons and chlorinated hydrocarbons. 12 refs., 1 tab.

32439 (FO/CAR–8812) **Salinity, temperature and density data for the Canadian Beaufort Sea shelf, March 1988.** Hopky, G.E.; Chiperzak, D.B.; Lawrence, M.J. Department of Fisheries and Oceans, Winnipeg, MB (Canada). Central and Arctic Region. 1988. 22p. (MICROLOG–89-01255). Available from Dept. of Fisheries and Oceans, Scientific Info. & Pubs. Branch, 200 Kent Street, 14th. Floor, Ottawa, ON, Canada K1A 0E6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

This report contains salinity, temperature and density (CTD) data collected in the waters of the Canadian Beaufort Sea Shelf during March 1988. Salinity and temperature profile data were measured using a Guildline Model 8870 probe deployed from the ice surface. Ice thickness was also measured. Density was calculated using salinity and temperature values. CTD profiles were measured at five stations. The maximum depths of profiles measured from the ice surface ranged from 31.2 to 16.8 dbar. Salinity and temperature measurements ranged from 0.35 to 34.83, and -1.87 to 1.08/sup 0/ C, respectively. The data presented in this report will assist in the identification and delineation of potential habitat types, as part of the Critical Arctic Estuarine and Marine Habitat Project of the Northern Oil and Gas Program. 5 refs., 7 figs., 6 tabs.

32440 (SCR–073) **Evaluation of wave forecasting models and forecast wind fields in the Canadian context.** Hodgins, S.L.M.; Hodgins, D.O. Seaconsult Marine Research Ltd., Vancouver, BC (Canada). 1988. 382p. (MICROLOG–89-01227). Available from Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.

Wave forecasting requirements in Canadian waters, current approaches to numerical wave prediction and the derivation of forecast wind fields by the Canadian Meteorological Centre (CMC), are reviewed. A strategy is then presented for organizing regional wave forecasts in relation to CMC's existing numerical weather prediction services, and recommendations on the steps required to achieve a high level of wave forecasting are presented. User requirements consist generally of forecasts of combined sea wave heights and periods for lead times of 12-24 h for the commercial fishery, and out to 36-48 h for offshore operators. When swell is expected its height, period, direction, and duration should be specified. Exploratory drilling and offshore construction operations that are motion-sensitive may also require wave spectra. The forecast data are specified in two formats, one showing temporal variations in wave properties at one location (for offshore drilling operations), and one showing the two-dimensional fields of heights, periods, and directions at several times. These requirements for wave data in Canadian waters are best met using numerical wave prediction models. In many areas, such as the Beaufort Sea, shallow-water effects must be taken into account. Model grid scales of the order of 2 to 20 km are required to resolve bathymetry, landforms, and sea ice. Such models are based on one of two approaches: empirical laws relating wave height and period to wind field properties and generation area, or semi-empirical relationships between wave energy spectra and wind over the generation area. CMC produces twice-daily prognosis wind fields suitable for wave modelling, available about 4 h after data time. It is concluded that to satisfy user needs, numerical calculations must be complete within 6 h of data time. 188 refs., 155 figs., 28 tabs.

64 PHYSICS I

Refer also to citation(s) 30986, 30990, 33025

6401 Astrophysics and Cosmology

Refer also to citation(s) 31795, 32365, 32472, 32760, 32876

32441 (AD-A-204377/6/XAB) **Solar-cycle dependence of the radial gradient of cosmic-ray intensity. Progress report for period ending 1988.** Van Allen, J.A. Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy. Dec 1988. 6p. Available from NTIS, PC A02/MF A01.

Pub. in Geophysical Research Letters, Vol. 15, No. 13, 1527-1530(Dec 1988).

Observation of the interplanetary intensity of cosmic rays (E_p > 80 MeV) by Pioneers 10 and 11 now spans a sixteen-year time period 1972-1988 and heliocentric radial distances, r10 and r11, out to 43.7 AU for Pioneer 10 and 25.8 AU for Pioneer 11. Solar modulation continues to be present at the current distances of both spacecraft. The radial gradient of intensity is measured continuously over the slowly varying, outward moving radial segment Delta = r10 - r11. The 50-day mean values of the gradient G vary systematically and cyclically in phase with solar activity as measured by sunspot number, with a maximum value of about 2.1 percent/(AU) at sunspot maximum and a minimum value of about 1.2 percent/(AU) at sunspot minimum. Thus, the apparent scale size of the heliospheric modulation region as measured by 1/G is about 48 AU at solar max and about 83 AU at solar min-a result that is the inverse of the conjectural inference of using most of the same body of data but a different analytical point of view. There is persuasive evidence that G is independent of radial distance over the range 2.5 to 34 AU in the mid-point of the segment Delta r. No dependence of G on heliographic latitude is evident, but this result does not lend itself to a quantitative statement.

32442 (AD-A-204474/1/XAB) **Micron-sized-particle impacts detected near Uranus by the Voyager 2 plasma-wave instrument. Progress report for period ending 1986.** Gurnett, D.A.; Kurth, W.S.; Scarf, F.L.; Burns, J.A.; Cuzzi, J.N. Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy. 22 Dec 1986. 53p. (U. OF IOWA--86-40). Available from NTIS, PC A04/MF A01.

During the Voyager 2 flyby of Uranus, the plasma-wave and radio-astronomy instruments detected a region of impulsive noise near the equatorial plane just inside the orbit of Miranda, at a radial distance of 4.51 RU. This noise is believed to be caused by micrometer-sized particles hitting the spacecraft. Analysis of various coupling mechanisms shows that when a dust particle is instantly vaporized and ionized, thereby releasing a cloud of charged particles, some are collected by the antenna. The resulting voltage pulse is detected by the plasma-wave instrument. Based on reasonable assumptions about the charge yield and collection efficiency of the antenna, the number density and mass of the particles can be estimated from the rate and amplitude of the voltage pulses. The analysis shows that the maximum number density of the particles is about .0016/cwm, and the thickness of the impact region, based on a Gaussian fit, is 3480 km. The maximum number density occurs slightly after the ring-plane crossing at a distance of about 280 km from the equatorial plane. Possible sources for these particles include the rings, the small satellite 1985U1 discovered outside the ring system, or other unseen small bodies that lie between synchronous orbit (3.15 RU) and 4.51 RU. If the particles are charged, electromagnetic forces produced by the rotating tilted dipole of Uranus may play a role in their transport and diffusion.

32443 (AD-A-204599/5/XAB) **Equations of cosmic-ray transport with distributed acceleration.** Letaw, J.R.; Roginsky, J. Severn Communications Corp., Millersville, MD (USA). 13 Jan 1989. 24p. (SCC--89-01). Available from NTIS, PC A03/MF A01.

The equations of cosmic-ray transport used in this galactic cosmic-ray propagation model are described. The equations include distributed acceleration terms associated with weak reacceleration of cosmic-ray ions in supernova remnants. Reacceleration may occur at any time during the diffusion of cosmic rays through the interstellar medium.

32444 (DOE/ER/40063--13) **The application of two-dimensional imaging to very high energy gamma ray astronomy: Progress report.** Smithsonian Astrophysical Observatory, Cambridge, MA (USA). Feb 1989. 16p. Sponsored by DOE Energy Research. DOE Contract AC02-82ER40063. Order Number DE89013614/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes the following topic on gamma ray astronomy: Crab Nebula, Hercules X-1, Cygnus X-3, high resolution camera, independent trigger, Monte Carlo simulations, optical design of large reflectors, South Pole experiment, galactic plane experiment, and air shower experiment. 8 figs.

32445 (ESA-SP--281) **Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.** Rolfe, E.J. European Space Agency, 75 - Paris (France). Jun 1988. 427p. (CONF-8804199--: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). Order Number DE89776503/JAW. Available from NTIS (US Sales Only), PC A19/MF A01.

These proceedings present recent I.U.E. results and also reviews of some selected topics studied with this satellite: solar system science, supernovae and their remnants, X-ray and cataclysmic binary systems, binary stars circumstellar matter and mass transfer, white dwarf stars, stellar activity, stellar atmospheres and variable stars.

32446 (ESA-SP--281) **Decade of UV astronomy with the IUE satellite. Volume 1. Proceedings of a celebratory symposium.** Rolfe, E.J. European Space Agency, 75 - Paris (France). Jun 1988. 402p. (CONF-8804199--: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

These proceedings present recent I.U.E. results and also reviews of some selected topics studied with this satellite: solar system science, supernovae and their remnants, X-ray and cataclysmic binary systems, binary stars circumstellar matter and mass transfer, white dwarf stars, stellar activity, stellar atmospheres and variable stars.

32447 (ESA-SP--281, pp. 183-186) **UV and optical line emission from the shell of the old nova GK Persei.** Bode, M.F. (Lancashire Polytechnic, Preston (UK). School of Physics and Astronomy); Duerbeck, H.W.; Seitter, W.C.; Albinson, J.S.; Evans, A. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199--: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

UV line emission is found in spectra taken of the brightest region (bar) of the shell of GK Per in 1987. This makes the remnant of the nova of 1901 the first classical nova nebula to have been detected in wavelengths from the radio region to the ultraviolet. Preliminary results suggest that the spectral line ratios can be fitted by a shock model under the assumption of an underabundance of hydrogen and an overabundance of nitrogen. The observed shock velocities in the range 100-200 km.s/sup -1/are characteristic of reverse shocks entering the nova ejecta.

32448 (ESA-SP--281, pp. 271-278) **Ultraviolet emission of accreting magnetic white dwarfs.** Bonnet-Bidaud, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Fondamentale (IRF)); Mouchet, M. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199--: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

The AM Her (polars) and DQ Her (intermediate polars) systems consist of a strongly magnetized white dwarf accreting from a low-mass companion. Most of the emission arises from the release of gravitational energy in X-rays and further reprocessing in UV and optical radiation through the accretion column. Recent EXOSAT observations and new optical data have led to a better knowledge of these systems. A large body of IUE data is also available but has not been fully emphasized. We present here a preliminary analysis of the ultraviolet continuum and emission line characteristics of these systems. The UV energy distribution is compared to different emitting contributions: the UV flux most probably results from X-ray heating of the column and of the surface of the white dwarf but cannot be explained by cyclotron radiation. The emission line intensities of the different systems are compared. The resonance line intensity

ratios are similar for both classes and are generally in accordance with what is expected from photoionization by soft X-rays. However two of these systems exhibit anomalous ratios, tentatively interpreted as due to abnormal abundances of carbon and nitrogen.

32449 (ESA-SP–281, pp. 287-290) **Ultraviolet emission from the sun and stars: a comparison of IUE and skylab spectra.** Cappelli, A. (Osservatorio Astrofisico di Arcetri, Florence (IT)); Cerruti-Sola, M.; Pallavicini, R.; Cheng, C.C. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

We present a comparison of IUE low-resolution SWP spectra of late-type stars and of high-resolution Skylab spectra of spatially-resolved solar regions of various degrees of magnetic activity (quiet areas, plages, flares). We degrade the high-resolution solar spectra to the same resolution of IUE and we analyze the solar and stellar data in exactly the same way. We show that the different levels of chromospheric and transition region emission observed in stars of similar spectral types are paralleled by a similar behaviour displayed by solar regions of different magnetic activity. We show that the spatially-resolved solar data obey the same flux-flux relationships as the stellar data over more than three orders of magnitude, with virtually the same slope and similar scatter. We argue that the similar behaviour of the solar and stellar UV line fluxes, together with the dependence of the stellar fluxes on rotation, are indirect evidence that stellar activity is of magnetic origin and likely results from a dynamo process. Finally, we investigate the contribution of blends, under different activity conditions, to line fluxes derived from IUE low-resolution spectra. We show that this contribution varies depending on the activity level, and may be substantial for the lines of O I at 1304 A and He II at 1640 A.

32450 (ESA-SP–281, pp. 405-408) **Au II in IUE spectra of chemically peculiar stars.** Fuhrmann, K. (Goettingen Univ. (DE)). European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

Heavy elements like platinum (Z=78), mercury (Z=80) and bismuth (Z=83) have been detected in IUE spectra of chemically peculiar stars within the last few years. From our recent work on HR 465, we report the additional identification of the odd-Z element gold (Z=79)in the spectra of some magnetic (CP2) as well as non-magnetic (CP3) stars. The importance of quantitative abundance analyses of the Pt-Au-Hg elemental sequence is pointed out, as well as a closer relationship between CP2 and CP3 stars as it may generally be assumed.

32451 (ESA-SP–281, pp. 409-412) **Validity of the classification of UV gallium stars.** Takada-Hidai, M. (Dominion Astrophysical Observatory, Victoria, British Columbia (CA)); Sadakane, K. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

Line intensities of Ga II at 1414 A and Ga III at 1495 A are surveyed on high-dispersion IUE spectra of seven stars classified as UV gallium stars on low-dispersion IUE spectra. The Ga II line intensity in HD 124224 is found to be weaker in all 11 high-dispersion spectra than that expexted from the spectral classification criteria. The remaining six stars show the strong Ga II line consistent with the classification criteria. A cross-check with the help of high-dispersion spectra must be effective in classification based on low-dispersion spectra.

32452 (ESA-SP–281, pp. 413-416) **Detected UV variability in the IUE spectra of the Ap-Si star HD 25823.** Freire Ferrero, R. (Institut d'Astrophysique Spatiale, 91 - Verrieres-le-Buisson (FR)); Artru, M.C. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

Spectral UV variabilities for the Ap-Si star HD 25823 are detected from five SWP IUE images we obtained during a week in 1987. This particular and magnetic star presents also an uncommon overabundance of gallium. From the observations, it seems that silicon and gallium (and others also) abundances varies accordingly to the rotational period of the star, as well as the magnetic field does. The anticorrelation observed between periodical variations of silicon and gallium confirms the predictions of the diffusion theory.

32453 (ESA-SP–281, pp. 417-422) **Galactic and LMC extreme emission line supergiants compared: IUE observations of the Henize - Carlson and Zoo star samples of massive supergiants.** Shore, S.N. (New Mexico Inst. of Mining and Technology, Socorro (US). Dept. of Physics); Sanduleak, N.; Brown, D.N.; Bopp, B.W.; Robinson, R. European Space Agency, 75 - Paris (France). Jun 1988. (CONF-8804199–: Celebratory symposium on a decade of UV astronomy with the IUE satellite, Greenbelt, Maryland, USA, 12 Apr 1988). In *Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium.* Order Number DE89012116/JAW. Available from NTIS (US Sales Only), PC A18/MF A01.

We report on the second epoch of a study of the Henize - Carlson sample of galactic massive supergiants, and a comparison between the Galactic and LMC samples. Several of the stars, notably He3-395 and S 127/LMC, have very similar shell characteristics. There appears to be little difference, other than luminosity, between the LMC and Galactic samples. One star, He3-1482, has been detected with the VLA at 6 cm. The UV data is combined with IRAS and optical information.

32454 (INIS-GB–186) **Ground based plan. A plan for research in astronomy and planetary science by ground based techniques.** Science and Engineering Research Council, Swindon (UK). 1989. 81p. Order Number DE89615604/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The paper presents a report of "The Ground Based Plan" of the United Kingdom Science and Engineering Research Council. The ground based plan is a plan for research in astronomy and planetary science by ground based techniques. The contents of the report contains a description of:- the scientific objectives and technical requirements (the basis for the Plan), the present organisation and funding for the ground based programme, the Plan, the main scientific features and the further objectives of the Plan. (U.K.).

32455 (INIS-mf–11401, pp. 301-306) **Spiral-vortex structure of flat galaxies (prediction, theory, laboratory and numerical experiments, observations).** Afanasiev, V.L. (AN SSSR, Nizhnij Arkhyz. Spetsial'naya Astrofizicheskaya Observatoriya); Baev, P.V.; Fridman, A.M.; Ivchenko, I.N.; Makov, Yu.N.; Pasha, I.I.; Polyachenko, V.L.; Morozov, A.G.; Torgashin, Yu.V.; Nezlin, M.V. Ceskoslovenska Akademie Ved, Ondrejov (Czechoslovakia). Astronomicky Ustav. 1987. (CONF-8708269–: 10. European regional astronomy meeting of the IAU, Prague, Czechoslovakia, 24-29 Aug 1987). In *Evolution of galaxies. Proceedings. Vol. 4.* Available from NTIS (US Sales Only), PC A21/MF A01 - OSTI; INIS.

Recent observations show a dip in the rotation curve for most spiral galaxies. Theoretically, it implies that spiral density waves must be induced by shear instabilities. Calculations prove that the observed amount of gas in galactic disks (10% for the Galaxy) is sufficient to develop the hydrodynamical instability in gas subsystems. As surface density perturbations of shallow water and galactic gas disks are described by the same equations, experiments with shallow water rotating similar to galactic disks were made. Stationary spiral patterns occur in stationary stages of rotation. The number of arms depends on the profile of rotation curve, in agreement with theoretical results. Different rotation parameters lead to different structures: the circular mode, one-, two-, ..., eight-armed spirals. Branching of the spirals is observed when rotation parameters change, which suggests that the spiral branching in several

galaxies comes from their non-stationary rotation. Anticyclonic vortices are observed between the arms. Azimuthal averaging of surface density σ/sub 0/(rho), gives a good fit for the Galaxy: a minimum of σ/sub 0/before the molecular ring. For realistic profiles of shallow water rotation the spirals are trailing. But they happen to be leading for opposite directions of the rotation of inner and outer regions. This may explain the leading spirals in galaxies whose spin is opposite either to that of close companions or to the vector of orbital momentum of the pairs. Numerical computations confirm the theoretical and experimental results. They also show a formation like a "molecular ring". Preliminary observational data agree with these results. (author). 11 figs.

32456 (INIS-SU–78, pp. 308) **Fast neutron contribution to nucleosynthesis reaction rates.** Petrov, Yu.V. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Shlyakhter, A.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

STARS/nucleosynthesis; FAST NEUTRONS; NEUTRON REACTIONS; NUCLEAR REACTION KINETICS; STARS; NUCLEOSYNTHESIS

32457 (INIS-SU–78, pp. 338-342) **Nucleosynthesis in the fast neutron capture processes.** Lyutostanskij, Yu.S. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow (USSR)); Malevannyj, S.V.; Panov, I.V.; Chechetkin, V.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The kinetic model of the nucleosynthesis for the nuclei with A<80 is developed. Different data for neutron-rich nuclei including the data obtained in the framework of finite fermi systems theory are used in calculations. the predicted abundances of heavy nuclei result in a model dependence of the Galaxy age. It is necessary to introduced the spike of nucleosynthesis before foundation of the solar system for correlation with this abundances. 14 refs.; 2 figs.

32458 (LA-UR–89-1507) **Scientific considerations in the design of the Mars observer gamma-ray spectrometer.** Arnold, J.R.; Boynton, W.V.; Englert, P.; Feldman, W.C.; Metzger, A.E.; Reedy, R.C.; Squyres, S.W.; Trombka, J.I.; Wanke, H. Los Alamos National Lab., NM (USA). 1987. 17p. Sponsored by National Aeronautics & Space Administration. DOE Contract W-7405-ENG-36. (CONF-8711149–4: Conference on high energy radiation background in space, Sanibel Island, Florida, USA, 2-5 Nov 1987). Order Number DE89012594/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Cosmic-ray primary and secondary particles induce characteristic gamma-ray and neutron emissions from condensed bodies in our solar system. These characteristic emissions can be used to obtain qualitative and quantitative elemental analyses of planetary surfaces from orbital altitudes. Remote sensing gamma-ray spectroscopy has been successfully used to obtain elemental composition of the Moon and Mars during United States Apollo 15 and 16 missions and the Soviet Luna and Mars missions. A remote sensing gamma-ray and neutron spectrometer will be included aboard the United States Mars Observer Mission. If proper care is not taken in the design of the spectrometer and choice of materials in the construction of the detector system and spacecraft, the sensitivity of these remote sensing spectrometers can be greatly degraded. A discussion of these design and material selection problems is presented. 16 refs., 5 figs., 3 tabs.

32459 (LA-UR–89-1760) **Spectra of crab-like pulsars: A GRO perspective.** Ho, Cheng. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-31109-ENG-38. (CONF-8904216–2: Gamma ray observatory science workshop, Greenbelt, Maryland, USA, 10-12 Apr 1989). Order Number DE89013461/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A single-parameter model has been constructed to calculate the continuum spectrum of energetic pulsed radiation resulted from the formation of a Crab-type charge depletion region (gap) in the outer magnetosphere of rapidly spinning pulsars (Ho 1989). We discuss the characteristics of the theoretical predictions for the Crab pulsar and the specific features expected in the energy bands of the Gamma-Ray Observatory (GRO). These features include a possible spectral dip in the 0.3 to 30 MeV range, a change in polarization behavior below and above the dip, if polarization can be discerned, and most importantly, an exponential roll-over in the energy range necessary to detect the exponential roll-over. This model predicts that the 50-ms pulsar in the Large Magellanic Cloud (PSR0540-693) will be marginally detectable by GRO with a nominal two-week integration. Furthermore, we discuss the spectrum and detectability of a pulsar with 0.5 ms period and a surface magnetic field of 10^9 G. Such pulsar may exist in SN 1987A. Since the 50-ms pulsar and SN 1987A are within the same field of view of GRO, it will be of great importance to take an extra long integration of this region to search for gamma-ray emission from these sources. 26 refs., 4 figs.

32460 (PB–89-154884/XAB) **Mass distribution in the galactic centre estimated from OH/IR stars.** Lindqvist, M.; Winnberg, A.; Matthews, H.E.; Olnon, F.M.; Habing, H.J. Chalmers Univ. of Tech., Goeteborg (Sweden). Onsala Space Observatory. 1988. 7p. (REPT–88/32). Available from NTIS, PC EE02/MF A01.

Preliminary results of a search for OH/IR stars in the Galactic Center using the VLA are presented. The goal of the project is to determine the mass density distribution from a few parsecs up to about 120 pc of the Galactic Center using stellar kinematics. Up to now, 125 OH/IR stars have been found. The distribution of the stars is clearly elongated with the major axis parallel to the galactic equator. The stars show a rotation of 117 km/s/deg with a dispersion of 90 km/s. Two preliminary models have been applied in order to determine the enclosed mass, resulting in M(r) = 4 million (r to the 1.4 power) Mo, where r is the galactocentric distance in parsecs.

32461 (PB–89-158356/XAB) **Solar-Geophysical Data Number 438, February 1981. Part 2 (comprehensive reports). Data for August 1980 and miscellanea.** Coffey, H.E. National Geophysical Data Center, Boulder, CO (USA). Feb 1981. 43p. (SGD–438-PT-2). Available from NTIS, PC A03/MF A01.

See also PB–89-158349.

Contents include: index for 1979-1980; August 1980 data – solar radio emission, solar x-ray radiation, and mass ejections from the sun; miscellaneous data – active regions Jun 8-Jul 5, 1980, synoptic solar maps Jun 8-Jul 4, 1980, energetic solar particles Feb 1980.

32462 (SAND–89-1234C) **Detection of very high energy γ-rays from the Crab nebula.** Akerlof, C.; DiMarco, J.; Levy, H.; Meyer, D.; Radusewicz, P.; Tschirhart, R.; Yama, Z.; MacCallum, C. Sandia National Labs., Albuquerque, NM (USA). 28 Apr 1989. 9p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789;AC02-76ER01112. (UM-HE–89-11;CONF-8904216–1: Gamma ray observatory science workshop, Greenbelt, Maryland, USA, 10-12 Apr 1989). Order Number DE89011840/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

During the period October 1988 through December 1988, a search was made for very high energy gamma rays from the direction of the Crab nebula using the atmospheric Cerenkov technique. The detector consisted of seven-fold arrays of photomultiplier tubes at the focii of two 11-meter diameter solar concentrators situated in Albuquerque, New Mexico. A DC signal was detected from the Crab nebula with a statistical significance of 5.8 σ after the application of various cuts designed to suppress the background of hadronic showers. A search for a pulsed component failed to identify a significant signal in phase with the radio pulse from the Crab pulsar. These results with a threshold energy of 200 GeV are in substantial agreement with high energy results recently reported by the Mt. Hopkins group. 16 refs., 3 figs., 3 tabs.

32463 (UCRL–98769) **Computer simulations of cosmic-ray diffusion near supernova remnant shock waves.** Max, C.E.; Zachary, A.L.; Arons, J. California Univ., Los Angeles, CA (USA).

Inst. of Geophysics and Planetary Physics. 15 Aug 1988. 8p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8808150–2: Varenna-Abastumani workshop on plasma astrophysics, Varenna, Italy, 24 Aug - 3 sep 1988). Order Number DE89012934/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have used a new plasma simulation model to study the resonant interactions between streaming cosmic-ray ions and a self-consistent spectrum of Alfven waves, such as might exist in the interstellar medium upstream of a supernova remnant shock wave. The computational model is a hybrid one, in which the background interstellar medium is an MHD fluid and the cosmic rays are discrete kinetic particles. The particle sources for the electromagnetic fields are obtained by averaging over the fast cyclotron motions. When the perturbed magnetic field is larger than about 10% of the background field, the macro- and micro-physics are no longer correctly predicted by quasi-linear theory. The particles are trapped by the waves and show sharp jumps in their pitch-angles relative to the background magnetic field, and the effective ninety-degree scattering time for diffusion parallel to the background magnetic field is reduced to between 5 and 30 cyclotron periods. We use our simulation results to suggest that Type I supernova remnants may be the principal sites of cosmic ray acceleration. 9 refs., 8 figs.

32464 (UCRL–101121) **Gamma ray bursts: Confrontation between theory and observational data.** Liang, E.P. Lawrence Livermore National Lab., CA (USA). 15 May 1989. 21p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8904216–3: Gamma ray observatory science workshop, Greenbelt, Maryland, USA, 10-12 Apr 1989). Order Number DE89012936/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This talk reviews the current observational data and theoretical models of cosmic gamma ray bursts. We summarize the evidences for and physics issues of a teragauss field neutron star interpretation. Constraints on the baseline emission scenario are highlighted. A brief comparison is given of some popular astrophysical models. We also suggest some priorities for future observations and data analyses. 45 refs., 12 figs., 3 tabs.

32465 Time evolution from linear to nonlinear stages in magnetohydrodynamic parametric instabilities. Hoshino, M. (Code 692, NASA-GSFC, Greenbelt, Maryland 20771(US)); Goldstein, M. L. *Physics of Fluids B: Plasma Physics (USA),* 1(7): 1405-1415 (Jul 1989).

The nonlinear evolution of the magnetohydrodynamic (MHD) parametricinstability of wave fluctuations propagating along an unperturbed magnetic fieldis investigated. Both a magnetohydrodynamic perturbation-theoretical approachand a nonlinear MHD simulation are used. It is shown that high harmonic wavesare rapidly excited by wave–wave coupling, and that the wave spectrum evolvesfrom a state containing a small number of degrees of freedom in *k* space toone which contains a large number of degrees of freedom. It is found that thespectral evolution prior to nonlinear saturation is well described by theperturbation theory. During this stage, the ratio of the growth rate of the*n*th harmonic wave to the linear growth rate of the fundamental wave is*n*. The nonlinear saturation stage is characterized by a frequency shift ofthe fundamental wave that destroys the wave–wave resonance condition which, inturn, causes the wave amplitude to cease its growth.

32466 Comment on "Reheated Universe by unstable neutrinos". Bernstein, J. (Department of Physics, Stevens Institute of Technology, Hoboken, New Jersey 07030(US)); Dodelson, S. *Physical Review Letters (USA),* 62(15): 1804-1804 (10 Apr 1989).

A comment on the letter by M. Fukugita, Phys. Rev. Lett. 61,1046 (1988).

32467 Inflation in a renormalizable cosmological model and the cosmic no-hair conjecture. Maeda, K. (Department of Physics, University of Tokyo, Bunkyo-ku, Tokyo 113, Japan(JP)); Stein-Schabes, J. A.; Futamase, T. *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 2848-2853 (15 May 1989).

The possibility of having inflation in a renormalizable cosmological model is investigated. The cosmic no-hair conjecture is proved to hold for all Bianchi types except Bianchi type IX. By the use of a conformal transformation on the metric we show that these models are equivalent to the ones described by the Einstein-Hilbert action for gravity minimally coupled to a set of scalar fields with inflationary potentials. Henceforth, we prove that inflationary solutions behave as attractors in solution space, making it a natural event in the evolution of such models.

32468 Consistency of quantum cosmology for models of plane symmetry. Matsuki, T. (Stanford Linear Accelerator Center, P.O. Box 4349, Stanford, California 94309(US)); Berger, B. K. *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 2875-2881 (15 May 1989). DOE Contract AC03-76SF00515.

The consistency of a *D*-dimensional quantum cosmology with (*D*–2)-dimensional plane symmetry is studied. For this class of models, it is shown that the effective Lagrangian in a minisuperspace for the *D*-dimensional Einstein Lagrangian has a form closely related to that for the bosonic string theory. In a restricted class of models, it has exactly the same form as that for the bosonic string theory, from which it is derived that the maximum number of spacetime dimensions in the quantized model must be *D*=29.

32469 Dray–'t Hooft geometries and the death of white holes. Blau, S. K. (Theoretical Division T8, Mail Stop B-285, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 2901-2903 (15 May 1989).

Astrophysical white holes may be modeled as special cases of the Dray–'t Hooft geometries. With this observation one may better understand the physics underlying the death of these white holes.

32470 Neutrino-electron scattering and the choice between different Mikheyev-Smirnov-Wolfenstein solutions of the solar neutrino problem. Rosen, S. P. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Gelb, J. M. *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3190-3193 (15 May 1989).

We consider the scattering of solar neutrinos by electrons as a means fordistinguishing between different MSW solutions of the solar neutrino problem.In terms of the ratio *R* between the observed cross section and that forpure electron-type neutrinos, we find some correlation between the value of*R* and each solution. A value of $R \leq$ 1/3 implies that theadiabatic solution is correct, while values between 1/3 and3/5 are consistent with the large-angle solution. A value closeto 1/2 is also consistent with the nonadiabatic solution, and avalue less than ((1/6– 1) /7) impliesoscillations into sterile neutrinos.

32471 Flux of atmospheric neutrinos. Barr, G. (CERN, 1211 Geneva 23, Switzerland(US)); Gaisser, T. K.; Stanev, T. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3532-3534 (1 Jun 1989).

We have repeated a one-dimensional calculation of neutrino fluxes,including the effect of muon polarization on neutrinos from the decay of muons.Fluxes have been calculated as a function of energy and angle with cutoffsappropriate for locations of five deep nucleon-decay experiments. Overall, theν_e/ν_μ ratio increases by 5% (20%) for neutrinos withenergies around 200 MeV (2–3 GeV), in agreement with a previousanalytic estimate of the effect.

6402 Atmospheric Physics

Refer also to citation(s) 31799, 32366, 32536

32472 (ACIESP–60(v.3)) **Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.** Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. 398p. (CONF-8808156– : 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

The most recent results of Brazil-Japan agreement for technological development on areas of space science and plasma, were presented. Problems related to: astrophysics, cosmic radiation interaction with earth atmosphere, plasma physics, and construction of rockets and satellites for space researches were discussed. (M.C.K.).

32473 (ACIESP–60(v.3), pp. 22-27) **Observation of high energy electrons and protons in the South Atlantic geomagnetic**

anomaly by Ohzora Satellite. Nagata, K. (Tanabe Seiyaku Co. Ltd., Osaka (Japan)); Murakami, H.; Nakamoto, A.; Hasebe, N.; Kikuche, J.; Doke, T. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

Observed results of the high energy electrons (0.19 - 3.2 MeV) and protons (0.58 - 35 MeV) of the South Atlantic Geomagnetic Anomaly are presented. Two silicon Δ E-E telescopes on the ohzora satellite (EXOS-C, 1984-15A) were used to observe the high energy particle and the maximum intensity of electrons and protons. The powers of energy spectra above 1 MeV have different values from energy region below 1 MeV. The electron and proton intensities are greatest at pitch angle maximized at 90/sup 0/.

32474 (ACIESP–60(v.3), pp. 28-34) **High energy electron and proton observations in the South Atlantic geomagnetic anomaly.** Nakamura, Y. (Institute of Space and Astronautical Science, Tokyo (Japan)); Takahashi, H.; Nagata, K.; Kohno, T.; Murakami, H. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

The method developed by researchers of cooperation agreement between Japan and Brazil, to observe high energy particles in the South Atlantic Geomagnetic Anomaly, is described. The energy spectra and pitch angle distributions of electrons and protons, using silicon detectors of good energy resolution and two spectrometers with different geometrical factors, on board of the OHZORA satellite, were determined. (M.C.K.).

32475 (ACIESP–60(v.3), pp. 71-77) **Intensity maps of MeV electrons and protons below the radiation belt.** Kohno, T. (Institute of Physical and Chemical Research, Wako, Saitama (Japan)); Munakata, K.; Murakami, H.; Nakamoto, A.; Hasebe, N.; Kikuchi, J.; Doke, T. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

The global distributions of energetic electrons (0.19 - 3.2 MeV) and protons (0.64 - 35 MeV) are shown in the form of contour maps. The data were obtained by two sets of energetic particle telescopes on board the satellite OHZORA. The observed altitude range is 350 - 850 Km. Ten degress meshes in longitude and latitude were used to obtain the intensity contours. A pitch angle distribution of J(α) = J(90). sin/sup n/α with n = 5/sup A/is assumed to get the average intensity in each mesh.

32476 (ACIESP–60(v.3), pp. 290-295) **Review of airglow observations at equatorial and low-latitudes in the Brazilian sector.** Sahai, Y. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Takahashi, H. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

A summary of observational facilities for airglow is presented, and some recent results obtained in the region of South Atlantic magnetic anomaly, are discussed. (M.C.K.).

32477 (AD-A–204376/8/XAB) **Electron-density depletions in the nightside auroral zone. Progress report.** Persoon, A.M.; Gurnett, D.A.; Peterson, W.K.; Waite, J.H.; Burch, J.L. Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy. 1 Mar 1988. 27p. Available from NTIS, PC A03/MF A01.

Pub. in Geophysical Research, Vol. 93, No. A3, 1871-1895(1 Mar 1988). Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

Measurements from instruments on board Dynamics Explorer 1 are used to study regions of diminished electron density in the nightside auroral zone. Local electron densities are obtained from the electron plasma frequency cutoff of the whistler-mode auroral hiss. Electron-density profiles are highly variable through the nightside auroral zone. Sharply defined regions of low electron densities are a common feature of auroral-zone crossings from the predusk hours until the early morning hours at all radial distances up to at lease 6.6 R_E. Electron densities in these regions are strongly depleted in relation to the adjacent polar cap and plasmaspheric densities, forming a low-density cavity at 70 + or - 5° invariant latitude. Minimum densities in the auroral cavity frequently fall to values below 0.3/cc and rarely exceed 3/cc at radial distances of 2-4.6 R_E. Within the cavity the electron-density profile exhibits extreme variability, with variations of a factor of 2 or more on spatial scales of tens of kilometers. Electron-plasma frequency to electron cyclotron frequency ratios of 0.02-0.4 are found inside the auroral cavity, consistent with the values required by theory for the generation of auroral kilometric radiation and Z mode radiation.

32478 (IRF-TR–34) **SPECTRUM - a computer algorithm to derive the flux-energy spectrum of precipitating particles from EISCAT electron density profiles.** Kirkwood, S. Swedish Inst. of Space Physics, Kiruna (Sweden). Oct 1988. 43p. Order Number DE89613581/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Three major improvements are included. First the new algorithm includes the time rate of change of ionisation. This can be measured on a time scale of a few seconds with the EISCAT radar during auroral precipitation. Second, the fixed energies of the incident electron beams assumed in the UNTANGLE program are replaced by energies which are calculated according to the altitudes at which measurements are made. Thus the energy resolution and energy interval included in the derived spectra are determined in a physically reasonable way by the altitude resolution and the altitude interval of the electron density measurements. Third, the equations relating the incident fluxes at each energy to the electron density at each altitude are written in matrix form which allows them to be solved using standard numerical algorithms. A possibility to fit proton fluxes rather than electron fluxes is also included. A companion program (PROFILE) which calculates ionisation rate or equilibrium electron density profiles for user-defined monoenergetic or Maxwellian particle precipitation has also been developed.

32479 (RAL–89-002) **Auroral electron accelerator. Manifestation of a universal ion/wave/electron interaction.** Bryant, D.A.; Hall, D.S. Rutherford Appleton Lab., Chilton (UK). Jan 1989. 43p. (CONF-8807168–: International conference on auroral physics, Cambridge, UK, 11-15 Jul 1988). Order Number DE89613582/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A model of the auroral electron acceleration process is presented in which the electrons are accelerated resonantly by lower-hybrid waves. The essentially stochastic acceleration process is approximated for the purposes of computation by a deterministic model involving an empirically derived energy transfer function. The empirical function, which is consistent with all that is known of electron energization by lower-hybrid waves, allows many, possibly all, observed features of the electron distribution to be reproduced. It is suggested that the process occurs widely in both space and laboratory plasmas.

32480 Short–time-scale evidence for strong Langmuir turbulence during hf heating of the ionosphere. Cheung, P. Y. (Department of Physics, University of California, Los Angeles, California 90024-1547(US)); Wong, A. Y.; Tanikawa, T.; Santoru, J.; DuBois, D. F.; Rose, H. A.; Russell, D. *Physical Review Letters (USA),* 62(23): 2676-2679 (5 Jun 1989).

Results of short-pulse, low–duty-cycle hf-heating experiments areshown to agree with predictions of a model of correlated, localized cavitonswhich undergo cycles of nucleation, collapse, and burnout. Predicted"free-mode" spectral features associated with the radiation of Langmuir wavesfrom collapsing cavitons are observed. Single radar pulse data provide evidencethat temporal correlations between caviton events are present at early timesfollowing the onset of heating.

6403 Atomic, Molecular, and Chemical Physics

Refer also to citation(s) 31642, 31643, 31786, 32605, 32787, 32844, 32873

32481 (AD-A–204040/0/XAB) **Excitation-transfer collisions in cesium vapor: CS(5d (5/2)) + CS(6s (1/2)) yields CS(5d (3/2)) + CS(6s (1/2)).** Keramati, B.; Masters, M.; Huennekens, J. Lehigh Univ., Bethlehem, PA (USA). Dept. of Physics. 1 Nov 1988. 10p. Available from NTIS, PC A02/MF A01.

Pub. in Physical Review A, Vol. 38, No. 9, 4518-4526(1 Nov 1988).

The excitation-transfer collision Cs(5D5/2) + Cs(6S) yields CS(5D3/2) + Cs(6S) was studied. The upper 5D5/2 state was excited by a c-w dye laser tuned to the one photon, quadrupole-allowed 6S yields 5D5/2 transition. Since the direct 5D yields 6P fluorescence could not be detected with our apparatus we monitored instead the cascade 6P yields 6S fluorescence. The ratio of 6P 1/2 to 6P3/2 fluorescence contains information on the collisional mixing that takes place in the 5D levels but also includes a significant contribution from mixing in the 6P levels. This latter contribution could effectively be subtracted out using the results of a second experiment in which a tunable cw diode laser was used to pump the 6P3/2 state, and the same fluorescence ratio monitored. The 5D mixing cross section obtained, 70 A, is significantly larger than previous indirect determinations.

32482 (AD-A–204042/6/XAB) **Inclusion of electron correlation for the target wave function in low- to intermediate-energy e-N_2 scattering.** Weatherford, C.A.; Brown, F.B.; Temkin, A. Florida Agricultural and Mechanical Univ., Tallahassee, FL (USA). Dept. of Physics. 1 Jun 1987. 7p. Available from NTIS, PC A02/MF A01.

Pub. in Physical Review A, Vol. 35, No. 11, 4561-4566(1 Jun 1987).

In a recent calculation an exact exchange method was developed for use in the partial-differential-equation approach to electron-molecule scattering, and was applied to e-N_2 scattering in the fixed-nuclei approximation with an adiabatic polarization potential at low energies (0-10 eV). Integrated elastic cross sections were calculated and found to be lower than experiment at energies both below and above the Pi sub g resonance. It was speculated at that time that improved experimental agreement could be obtained if a correlated target representation were used in place of the uncorrelated one. This paper implements this suggestion and demonstrates the improved agreement. These calculations are also extended to higher energies (0-30 eV) so as to include the Sigma sub u resonance. Some discrepancies among the experiments and between experiment and the various calculations at very low energy (<1eV) are noted.

32483 (AD-A–204043/4/XAB) **Analytical evaluation of multicenter molecular integrals over Slater-type orbitals using expanded Loewdin alpha functions.** Jones, H.W. Florida Agricultural and Mechanical Univ., Tallahassee, FL (USA). Dept. of Physics. 15 Jul 1988. 6p. Available from NTIS, PC A02/MF A01.

Pub. in Physical Review A, Vol. 38, No. 2, 1065-1068(15 Jul 1988).

The Loewdin alpha functions, which are the functions associated with the spherical harmonic expansion of a displaced Slater-type orbital, are expressed using C matrices to represent the polynomials in terms of the displacement distance a and the radial distance r. These polynomials are multiplied by the sum and difference of exponentials. The expansion of the exponentials leads to the use of E and F matrices. By keeping only the r variable identifiable, further simplifications of the alpha functions are possible, which makes for easy programming of all multicenter integrals. Also, no singularities appear in these developments. Everything is demonstrated by using 1s orbitals as prototypes.

32484 (AD-A–204433/7/XAB) **Photoabsorption and photoionization cross sections: an overview of the current state of knowledge.** Manson, S. Georgia State Univ., Atlanta, GA (USA). Dept. of Physics. 1988. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Spie, Vol. 911, X-Ray and Vacuum Ultraviolet Data Bases, Calculations, and Measurements (1988).

An overview of the current state of knowledge of atomic photoabsorption and photoionization cross sections is presented. At high photon energies (<10 keV) the cross sections are generally well understood, except near thresholds. At lower energies the situation becomes dramatically poorer. A prospectus for amelioration of the problems is discussed.

32485 (AD-A–204434/5/XAB) **Photoionization cross sections of positive ions.** Manson, S. Georgia State Univ., Atlanta, GA (USA). Dept. of Physics. 1 Jul 1988. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Physical Review A, Vol. 38, No. 1(1 Jul 1988).

Recent experiment on K^+ is compared with measurements on neutral K to test the suggestion that inner-shell photoionization cross sections are largely unaffected by the removal of outer-shell electrons.

32486 (AD-A–204435/2/XAB) **Photoionization of Al^+ ions: a relativistic random phase approximation study.** Manson, S.T.; Nasreen, G.; Deshmukh, P.C. Georgia State Univ., Atlanta, GA (USA). Dept. of Physics. 1 Jul 1988. 3p. Available from NTIS, PC A02/MF A01.

Pub. in Physical Review A, Vol. 38, No. 1(1 Jul 1988).

The photoionization cross section for Al^+ was calculated within the framework of the relativistic random-phase approximation including all 1s,2s,2p, and 3s channels. Except for the first few eV above threshold, it is found that the simple Hartree-Slater central-field result agrees with this cross section 10% or better, indicating that multichannel effects drop of rapidly with stage of ionization.

32487 (AD-A–204475/8/XAB) **R-f spectroscopy of trapped neutral atoms.** Martin, A.G.; Helmerson, K.; Bagnato, V.S.; Lafyatis, G.P.; Pritchard, D.E. Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics. 21 Nov 1988. 8p. Available from NTIS, PC A02/MF A01.

The first observation of rf-induced transitions of trapped neutral atoms. An rf resonance curve for a sample of trapped Na atoms was obtained by measuring the relative population of two trapped magnetic substates as a function of applied rf frequency. The shape of the resonance curve was used to determine the energy distribution of the trapped atoms.

32488 (ANU-P–999) **Measurement of the mass of /sup 39/Sc.** Woods, C.L.; Catford, W.N.; Fifield, L.K.; Orr, N.A. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Feb 1988. 17p. Order Number DE89615411/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The mass of the proton-rich nucleus /sup 39/Sc has been derived from a measurement of the Q-value of the /sup 40/Ca(/sup 14/N, /sup 15/C)/sup 39/Sc reaction at a beam energy of 102.5 MeV and mean reaction angle of 6 deg. A value of -27.67±0.03 MeV was obtained for the ground state of /sup 39/Sc, which is therefore unbound to proton emission by an energy of 580±30 keV. There is some evidence for an excited state in /sup 39/Sc at an energy of 950±40 keV. This state is tentatively identified as the analog of the 1.27 MeV 3/2/sup -/state in /sup 39/Ar. The cross sections to the 1/2/sup -/and 5/2/sup -/states in /sup 15/C confirm an earlier suggestion that this reaction is well suited to the observation of proton-rich nuclei via direct transfer reactions having very negative Q-values.

32489 (CONF-890517–1) **Subexcitation electrons in gas phase.** Kimura, M.; Inokuti, M.; Kowari, K. Argonne National Lab., IL (USA). 1989. 22p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 10. symposium on microdosimetry; Rome, Italy; 21-26 May 1989. Order Number DE89013300/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Subexcitation electrons, conventionally defined as those whose kinetic energies are below the first electronic excitation threshold, play an important role for a variety of phenomena such as vibrational and rotational excitation of molecules, negative ion formation and solvated electrons in liquids seen in radiation physics and chemistry. The current knowledge of behavior of subexcitation electrons in gas phases is reviewed. 16 refs., 8 figs.

32490 (CONF-8905141–1) **Atomic physics using large electrostatic accelerators.** Datz, S. Oak Ridge National Lab., TN

(USA). 1989. 33p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 5. international conference on electrostatic accelerators and associated boosters; Strasbourg, France; 24-27 May 1989. Order Number DE89012500/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This article surveys some areas of atomic physics using large electro-static accelerators. Brief overviews of ion-atom collisions and ion-solid collisions are followed by a classified listing of recent paper. A single line, correlated electron ion recombination, is chosen to show the recent development of techniques to study various aspects of this phenomenon. 21 refs., 11 figs., 1 tab.

32491 (DOE/ER/13745–2) **Metastable enhancement of C^+ and O^+ capture reactions: Annual report, July 1, 1988–June 30,1989.** Thomas, E.W.; Moran, T.F. Georgia Inst. of Tech., Atlanta, GA (USA). 10 May 1989. 8p. Sponsored by DOE Energy Research. DOE Contract FG05-87ER13745. Order Number DE89012735/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The project seeks to study the charge capture reactions of C^+ and O^+ in various gases (principally H_2 and He) to determine the difference between cross sections for the ground and metastable excited states of the projectile species. Emphasis is on very low energy collisions close to threshold and data in practice extends over collision energies from 10 to 500 eV; comparison can be made with data from other sources at higher energies. In general terms cross sections for the metastable species are higher by a factor of ten than for the ground state at low energies (10 eV), are surprisingly invariant with energy, are approached by the ground state cross sections at about 10^5 eV, after which both cross sections fall. We have shown also that the metastable content of C^+ and O^+ fluxes produced by dissociative ionization of various carbon containing molecules is 15 to 30%. We conclude that in the consideration of a situation involving neutralization of C^+ and O^+ (as for example in the edge of a fusion plasma) the metastable content may be high and will influence the net cross section significantly. Present data are not always in agreement with previously published results.

32492 (DOE/FTR–9012477) **[Symposium on the Auger Effect, Paris, Orsay, and Limeil, France, March 29–30, 1989 and April 3–7 and 20–21, 1989]: Foreign trip report.** Rozsnyai, B.F. Lawrence Livermore National Lab., CA (USA). 18 May 1989. 5p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE89012477/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of the trip was to attend and give a presentation at the Symposium on the Auger Effect, to finish a joint work with Dr. Lamoureux of CNRS, LSAI, on bremsstrahlung in plasmas and to discuss some basic physics (unclassified) connected with opacity calculations with the principal investigators at the Centre d'Etudes de Limeil. The activities of this trip are part of the traveler's responsibility to conduct research in radiative properties of hot plasmas. This is a center of interest at the Lawrence Livermore National Laboratory.

32493 (INIS-BR–1458, pp. 32) **Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method.** Kerur, B.R. (Karnatak Univ., Dharwar (India). Dept. of Physics); Jahagirdar, H.A.; Hanumaiah, B.; Thontadarya, S.R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALUMINIUM/total cross sections; ALUMINIUM/x radiation; COPPER/total cross sections; COPPER/x radiation; LEAD/total cross sections; LEAD/x radiation; NICKEL/total cross sections; NICKEL/x radiation; SILVER/total cross sections; SILVER/x radiation; TIN/total cross sections; TIN/x radiation; ALUMINIUM; ATOMIC NUMBER; COPPER; KEV RANGE 10-100; LEAD; NAI DETECTORS; NICKEL; PEAKS; SILVER; TIN

32494 (INIS-BR–1458, pp. 33) **M-shell x-ray fluorescence cross section measurements for some elements with $72<Z<92$ at 5.96 KeV.** Singh, S. (Panjab Univ., Chandigarh (India)); Mehta, D.; Kumar, S.; Garg, M.L.; Singh, N. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

M SHELL/photon beams; M SHELL/x-ray fluorescence analysis; PHOTON BEAMS/atoms; PHOTON BEAMS/kev range 01-10; ATOMIC NUMBER; CROSS SECTIONS; K SHELL; L SHELL; LI-DRIFTED SI DETECTORS; ATOMS

32495 (INIS-BR–1458, pp. 16) **Calculation of electron-pair creation cross sections on Sn and U.** Sud, K.K. (Costa Rica Univ., San Jose. Escuela de Fisica); Vargas, C.W.S. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRON PAIRS/mev range 01-10; ELECTRON PAIRS/pair production; PAIR PRODUCTION/electron pairs; PAIR PRODUCTION/photon beams; PHOTON BEAMS/pair production; PHOTON BEAMS/tin; PHOTON BEAMS/uranium; ATOMIC NUMBER; COMPARATIVE EVALUATIONS; DIFFERENTIAL CROSS SECTIONS; DWBA; TIN; URANIUM; TOTAL CROSS SECTIONS

32496 (INIS-BR–1458, pp. 40) **Inelastic scattering of gamma rays from K-shell electrons of tantalum.** Ghumman, B.S. (Punjabi Univ., Patiala (India). Dept. of Physics); Singh, B.; Singh, G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAMMA RADIATION/inelastic scattering; GAMMA RADIATION/k shell; GAMMA RADIATION/tantalum; ANGULAR DISTRIBUTION; ENERGY SPECTRA; TANTALUM; KEV RANGE 100-1000; NAI DETECTORS

32497 (INIS-BR–1458, pp. 100) **Atomic fluorescence yields W/sub M4/, W/sub M5/, W/sub N4/and W/sub N5/of the elements Ir,Pt,Au,Th and U.** Ferreira, J.G. (Lisboa Univ. (Portugal). Dept. de Fisica); Salgueiro, L.; Parent, F.; Amorim, P. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GOLD/fluorescence; IRIDIUM/fluorescence; PLATINUM/fluorescence; THORIUM/fluorescence; URANIUM/fluorescence; GOLD; FLUORESCENCE; IRIDIUM; L SHELL; LEVEL WIDTHS; LINE WIDTHS; M SHELL; N SHELL; PLATINUM; THORIUM; URANIUM; X RADIATION

32498 (INIS-BR–1458, pp. 105) **Dependence of $K\beta/K\alpha$ ratio on the chemical constitution of the atom in Cr, Mn and Fe.** Sastry, D.L. (Andhra Univ. Visakhapatnam (India). Labs. for Nuclear Research); Raghavaiah, C.V.; Venkateswara Rao, N.; Bhuloka Reddy, S.; Chandrasekhar Rao, M.V.S.; Sreekrishna Murty, G.; Satyanarayana, G. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

CHROMIUM/chemical bonds; CHROMIUM/x-ray emission analysis; IRON/chemical bonds; IRON/x-ray emission analysis; MANGANESE/chemical bonds; MANGANESE/x-ray emission analysis; CHROMIUM; IRON; K SHELL; LI-DRIFTED SI DETECTORS; MANGANESE; MULTI-CHANNEL ANALYZERS; X-RAY TUBES

32499 (INIS-BR–1458, pp. 106) **M-subshell ionization of U by light ion bombardment.** Jesus, A.P. (Centro de Fisica Nuclear, Lisbon (Portugal)); Ribeiro, J.P. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ALPHA BEAMS/uranium; DEUTERON BEAMS/uranium; PROTON BEAMS/uranium; URANIUM/inner-shell ionization; URANIUM/

m shell; URANIUM; BINDING ENERGY; CROSS SECTIONS; KEV RANGE 100-1000; X RADIATION

32500 (INIS-BR–1458, pp. 111) **Elastic and inelastic scattering of 59.54 KeV gamma rays.** Varier, K.M. (Calicut Univ. (India). Dept. of Physics); Unnikrishnan, M.P. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

GAMMA RADIATION/elastic scattering; GAMMA RADIATION/inelastic scattering; GAMMA RADIATION/kev range 10-100; ALUMINIUM; COPPER; CROSS SECTIONS; FORM FACTORS; GOLD; LEAD; LI-DRIFTED SI DETECTORS; MOLYBDENUM; TANTALUM; YTTERBIUM

32501 (INIS-BR–1458, pp. 116) **Influence of the beam aperture on the Compton line profile.** Mainardi, R.T. (Cordoba Univ. (Argentina)); Sartori, R. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

BEAM PROFILES/compton spectrometers; AMERICIUM 241; ANGULAR DISTRIBUTION; HIGH-PURITY GE DETECTORS; RADIATION SOURCES; RESPONSE FUNCTIONS

32502 (INIS-BR–1458, pp. 119) **Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu.** Lusem, H. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics-Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ION PAIRS/gases; ION PAIRS/ionization; IONIZATION/gases; IONIZATION/ion pairs; LEAD IONS/gases; URANIUM IONS/gases; XENON IONS/gases; ACCELERATORS; ENERGY ABSORPTION; GASES; IONIZATION; MEV RANGE 01-10

32503 (INIS-BR–1483, pp. 33) **Landau levels of the two-dimensional electron systems in the corbino geometry.** Aristone, F. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Studart, N. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SINGLE-PARTICLE MODEL/electrons; SINGLE-PARTICLE MODEL/two-dimensional calculations; COUPLING CONSTANTS; ENERGY SPECTRA; GAUGE INVARIANCE; MAGNETIC FIELDS; MATRIX ELEMENTS; ELECTRONS; VARIATIONAL METHODS; WAVE FUNCTIONS

32504 (INIS-SU–74/A, pp. 57-63) **On two variants of solving the eigenvalue problem for a system of second-order differential equations in the method of many-dimensional angular coulomb functions.** Golubev, A.I.; Povyshev, V.M.; Sadovoj, A.A.; Saraeva, M.K. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. (In Russian). In *Methods and programs for numerical solution of the mathematical physics problems. Scientific-technical collection.* Order Number DE89012113/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

Voprosy atomnoj nauki i tekhniki.; no. 2.

Consideration is being given to application of two numerical methods for solving eigenvalue problem a system of usual differential equations, ocurring in multi-electron theory of atom when using the method of many-dimensional angular Coulomb functions, Galerkin method, and the method of Sturm function expansion. Results of numerical calculations, illustrating the convergence of both methods are presented. 9 refs.; 6 tabs.

32505 (LA–11575-T) **Observation of the negative muonium ion in vacuum.** Kuang, Yunan. Los Alamos National Lab., NM (USA). c May 1989. 123p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE89013175/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The negative muonium ion (M^-), which is the bound system of a positive muon and two electrons, has been produced and observed for the first time. Its counterpart H^- is well known, and spectroscopy and collision studies with H^- have yielded many fruitful results. Noteworthy are recent investigations of the photoionization of a relativistic H^- beam. The negative positronium ion has also been formed and observed. The discovery of M^- provides us with a new leptonic system for spectroscopy and collision studies, which may reveal interesting physics associated with mass effects. Since M^- is a charged particle, it can also be used to produce a beam of exotic atoms with a small phase space. This dissertation is a detailed account of the observation of M^-. 93 refs., 54 figs., 18 tabs.

32506 (LA-UR–89-1607) **Final state effects in liquid ^{4}He: An experimental test.** Sokol, P.E.; Silver, R.N.; Sosnick, T.R.; Snow, W.M. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8810118–8: Workshop on momentum distributions, Argonne, Illinois, USA, 24-26 Oct 1988). Order Number DE89012615/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Inelastic neutron scattering at high momentum transfers can provide direct information on the atomic momentum distribution n(p) when the Impulse Approximation (IA) is valid. In isotropic systems, the scattering in the IA is directly proportional to the longitudinal momentum distribution which is a function of a single scaling variable $Y \equiv (M/Q)(\omega - \omega_r)$, where M is the mass of the scatterer, Q is the momentum transfer, and $\omega_r = Q^2/2M$ is the recoiled energy. However, the experimentally attainable Q's are not large enough to reach the IA limit. Deviations from the IA due to final state scattering by neighboring atoms, known as final state effects, will distort the observed scattering from the IA prediction. Thus, an understanding of deviations from the IA is essential to accurate determination of n(p). Liquid helium provides an excellent testing ground for studying FSE in a dense, strongly interacting system for two reasons. First, theoretical calculations of the momentum distributions are available in both the normal liquid, and superfluid phases. These calculations are believed to be quite accurate, since they agree well with several other measured properties of the liquid. In addition, n(p) in the superfluid exhibits a very sharp feature, the Bose condensate peak, which should be very sensitive to FSE. Comparison of the predicted scattering obtained from the theoretical n(p) using the IA to the experimentally observed scattering can be used to study deviations due to FSE. 14 refs., 7 figs.

32507 (PPPL–2617) **Quenching of Einstein's A-coefficients by photons.** Aumayr, F.; Hung, J.; Suckewer, S. Princeton Univ., NJ (USA). Plasma Physics Lab. May 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89012829/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present evidence for the quenching of Einstein A-coefficients in an Ar-ion laser discharge due to the presence of a high intensity laser flux. The reduction in spontaneous emission intensity when lasing occurs was found to be dependent on the Einstein A-coefficient for transitions originating from the same upper level. 9 refs., 3 figs.

32508 (UCRL–52000-89-2-3) **Energy and Technology Review, February–March 1989.** Poggio, A.J. (ed.); Graboske, H.C. Jr. (ed.). Lawrence Livermore National Lab., CA (USA). Mar 1989. 66p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE89012251/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

During the first three decades of this century, when modern physics was being created, the physics of the atom–atomic physics–posed the central experimental questions and produced the theoretical answers that led to the great advances of quantum mechanics and, later, quantum field theory. After this sustained burst of development, other newer physics disciplines became preeminent and atomic physics settled into a consolidation phase. Now, we again face important and interesting questions about atomic physics–questions that were not raised during that first grand effort. The questions are posed by technical projects that have world-wide

recognition and value. For example, international research on magnetic and inertial confinement fusion is a major source of issues in atomic physics. The design of high-power and short-pulse lasers, the propagation of the laser beam, and the interaction of the beam with various targets also pose major atomic physics challenges. Today it is possible to identify and address these issues because new scientific regimes are opening, new technologies are developing, and new applications challenge our scientific resources. This developmental process further promotes fertile interactions among the various physics disciplines.

32509 Algebraic approach to molecular electronic spectra. I. Energy levels. Frank, A. (Instituto de Ciencias Nucleares, UNAM, Apto. Postal 70-543, 04510 Mexico D.F., Mexico(US)); Lemus, R.; Iachello, F. *Journal of Chemical Physics (USA),* 91(1): 29-41 (1 Jul 1989).

An algebraic approach to molecular electronic spectra is presented. Thisapproach is used to provide a simultaneous description of electronic,vibrational and rotational energy levels in the series of molecules LiH, BeH,BH, CH, NH, and OH.

32510 The Far-IR spectra of UO_2, α-U_3O_8, and γ-UO_3 using the light pipe reflection method. Yu, B. (Department of Physics, Utah State University, Logan, Utah 84322 (B.-Z.Y., W.N.H.)); Hansen, W. N.; Ward, J. *Applied Spectroscopy (USA),* 43(1): 113-117 (Jan 1989).

The spectra of UO_2, α-U_3O_8, and γ-UO_3 in the 700–20 cm^{-1}range were examined with an FT-IR spectrometer with the use of aCassegrainian-type light pipe cell. Generally, the light pipe reflection spectraobtained show more detail than the transmission measurements. Someweak peaks of lattice mode vibrations have been found. The coincidenceof several spectral features in α-U_3O_8 and UO_2 provides evidence thattheir structures are correlative. The spectra of γ-UO_3 in this region arethe first reported.

32511 Atomic *K*-, *L*-, and *M*-shell cross sections for ionization by protons: A relativistic Hartree-Slater calculation. Mau Hsiung Chen (High Temperature Physics Division, Lawrence Livermore National Laboratory, University of California, Livermore, California 94550(US)); Crasemann, B. *Atomic Data and Nuclear Data Tables (USA),* 41(2): 257-286 (Mar 1989). DOE Contract W-7405-ENG-48.

Relativistic direct ionization cross sections for proton impact have been evaluated with Dirac–Hartree–Slater wave functions for atomic *K*, *L*, and *M* shells. Corrections for binding, polarization, and Coulomb deflection are included. Results are tabulated for proton energies from 3.25 to 5 MeV for the *K* shell and 1 to 5 MeV for the *L* subshells, for 28 elements with atomic numbers $22 \leq Z \leq 92$. For *M*-subshell cross sections, results are tabulated for 15 elements with $54 \leq Z \leq 92$, for proton energies from 0.06 to 2 MeV.

32512 *K*- and *L*-shell ionization cross sections for deuterons calculated in the ECPSSR theory. Cohen, D. D. (Australian Institute of Nuclear Science and Engineering, Private Mail Bag 1, P.O. Menai, New South Wales, 2234, Australia(US)). *Atomic Data and Nuclear Data Tables (USA),* 41(2): 287-338 (Mar 1989).

Ionization cross sections for *K* and *L* subshells are tabulated according to target atomic number and incident deuteron energy. Deuteron energies between 100 keV and 10 MeV and selected targets between C and Am for the *K* shell and between Ar and Am for the *L* subshells are used. The cross sections have been calculated in the plane-wave Born approximation (PWBA) with corrections for energy loss (E), Coulomb deflection (C), perturbed stationary states (PSS), and relativistic (R) effects (ECPSSR). Differences between the computational approach of Cohen and Harrigan and that of Brandt and Lapicki are delineated, and the ratios of the resulting cross sections are tabulated. © 1989 Academic Press, Inc.

32513 Ten low-lying electronic states of Pd_3. Balasubramanian, K. (Department of Chemistry, Arizona State University, Tempe, Arizona 85287-1604(US)). *Journal of Chemical Physics (USA),* 91(1): 307-313 (1 Jul 1989).

Multiconfiguration self consistent field (MCSCF) followed by multireferencesingles plus doubles configuration interaction (MRSDCI) calculations, includingup to two million configurations, are carried out on low-lying electronic statesof Pd_3. In addition, spin-orbit effects are included using a relativisticconfiguration interaction (RCI) method. There are at least ten low-lyingelectronic states in the absence of spin-orbit coupling (and more whenspin-orbit effects are included) of $^1A_2$, $^3B_2$, $^3A_1$,$^1A_1$, $^3A_2$, $^3B_1$, $^5A_2$, $^5B_1$ symmetry withisosceles triangle structures. The calculated density of states is in accordwith the recently observed photoelectron spectrum of Pd^-_3. The Pd_3trimer was found to be more stable than the dimer with an atomization energy of124 kcal/mol in the ground state with respect to the separated Pd(^3D)atoms. The Mulliken population analysis of the MRSDCI natural orbitals revealthat the apex atom of the isosceles triangle has a considerably larger *s*population in comparison to the base atoms, while the base atoms have larger*d* populations in most of the electronic states. All the electronic states ofPd_3 exhibit small hybridization of 5*p* orbitals of the palladium atoms.

32514 Energy levels and transition probabilities in the ground-state configuration of sulfur-like ions. Saloman, E. B. (National Bureau of Standards, Gaithersburg, Maryland 20899(US)); Kim, Y. *Atomic Data and Nuclear Data Tables (USA),* 41(2): 339-356 (Mar 1989).

Theoretical level values have been calculated for the energy levels of the $3s^23p^4$ ground-state configuration of all sulfur-like ions of atomic number Z=16–92. Transition probabilities have been obtained for the magnetic dipole (*M*1) and electric quadrupole (*E*2) transitions within this configuration. The calculations were by means of a multiconfiguration–Dirac–Fock technique which included perturbatively the Breit interaction and the Lamb shift for the *K*-, *L*-, and *M*-shell electrons. Results are presented which use experimental and semiempirical fits to level energies for ions with atomic numbers up to Z=42. Above Z=42, purely theoretical results are given. It is shown that the agreement between our theoretical results and the semiempirical values of the level energies improves rapidly as Z increases, with all values in excellent agreement by Z=42.

32515 Characterization of several ultraviolet–visible emission lines from a lead hollow-cathode lamp. Simons, J. W. (Department of Chemistry, New Mexico State University, Las Cruces, New Mexico 88003(US)); Palmer, B. A.; Hof, D. E.; Oldenborg, R. C. *Journal of the Optical Society of America B: Optical Physics (USA),* 6(6): 1097-1102 (Jun 1989).

The Fourier-transform spectra (0.015-cm^{-1} resolution) of thenonresonant 405.8-, 368.4-, and 364.0-nm lines and the resonant 283.3-nm linefrom a lead hollow-cathode lamp are reported. The splittings for the variousisotopic and nuclear hyperfine transitions for all four lines are found to beconsistent with previous measurements and assignments. At the recommended lampoperating current of 4 mA, all peak shapes within all four lines studied weresatisfactorily fitted with Gaussian functions corresponding to the same Dopplertemperature of 750±30 K, indicating no significant self-absorption of the283.3-nm resonant line. At a much-elevated lamp current the peaks for thenonresonant lines are increased in intensity and slightly broadened, whereas thepeaks for the resonant line have approximately the same intensity as at 4 mA butare no longer Gaussian shaped.

32516 Electron-electron interactions in transfer and excitation in F^{8+}→H_2 collisions. Schulz, M. (Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831(US)); Giese, J. P.; Swenson, J. K.; Datz, S.; Dittner, P. F.; Krause, H. F.; Schone, H.; Vane, C. R.; Benhenni, M.; Shafroth, S. M.; and others. *Physical Review Letters (USA),* 62(15): 1738-1741 (10 Apr 1989). DOE Contract AC05-84OR21400.

We have measured projectile Auger electrons emitted after collisions ofH-like F with H_2. The cross sections for emission of *KLL*,*KLM*, *KLN*, and *KLO* Auger electrons show maxima as a functionof the projectile energy. One maximum in the *KLL* emission cross sectionis due to resonant transfer and excitation. A second maximum in the crosssection for *KLL* emission as well as the maxima in the emission crosssection for the higher-*n* Auger electrons are attributed to a new transferand excitation process. This involves excitation of a projectile electron byone target electron accompanied by the capture of a second target electron.

32517 Focusing of particle beams using two-stage laser ablation. Kadar-Kallen, M. A. (Department of Physics, Princeton

University, Princeton, New Jersey 08544(US)); Bonin, K. D. *Applied Physics Letters (USA),* 54(23): 2296-2298 (5 Jun 1989).

We report a new technique for producing focused beams of neutrals, ions, andclusters using two-stage laser ablation. We have produced a collimated beam andbeams which were focused in one and two dimensions. The on-axis density is5×10^{15} atoms/cm^3 for a barium beam focused in two dimensions over adistance of 10.7 cm. For a collimated beam the density is 10^{15} atoms/cm^{3}at the same distance.

32518 Recoil distributions in particle transfer. McGuire, J. H. (Department of Physics, Kansas State University, Manhattan, Kansas 66506(US)); Straton, J. C.; Axmann, W. J.; Ishihara, T.; Horsdal, E. *Physical Review Letters (USA),* 62(25): 2933-2936 (19 Jun 1989).

Classical Thomas peaks in various fast second-order particle transferprocesses are quantum mechanically broadened by energy nonconservation in theintermediate states of a collision. This quantum broadening is considered inobservable velocity distributions of recoil particles.

32519 Three-body molecular formation in muon-catalyzed *d-t* fusion: The role of configuration mixing. Leon, M. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)). *Physical Review [Section] A: General Physics (USA),* 39(11): 5554-5559 (1 Jun 1989).

Configuration mixing of the rotational states of the $[(dt\mu)d2e]^+$ complex formed in $t\mu$+D_2 collisions arises because of the torque exerted on it by any neighboring molecule. The resulting three-body term in the resonant molecular formation rate is calculated in the quasistatic picture and turns out to be comparable to the two-body term. Numerical results are presented for several values of the $(dt\mu)_{11}$ binding energy. This effect may be large enough to explain the observed three-body effect in molecular formation without the collisional line-broadening contributions discussed previously.

32520 Absolute photoionization cross sections of the Cs $7D_{3/2}$ level measured by use of fluorescence reduction. Bonin, K. D. (Department of Physics, Princeton University, Princeton, New Jersey 08544(US)); Gatzke, M.; Collins, C. L.; Kadar-Kallen, M. A. *Physical Review [Section] A: General Physics (USA),* 39(11): 5624-5632 (1 Jun 1989).

A simple technique for measuring absolute photoionization cross sections σ of excited atoms has been applied to the $7D_{3/2}$ level in Cs. Past experiments on excited-state cross sections have relied on measurements of the total number of ions or photoelectrons produced by photoionization to deduce σ. Our technique is novel in that it utilizes the simple measurement of the reduction in the excited-atom fluorescence due to photoionization to find σ. We report measurements of cross sections at six different photon energies.

32521 Laser-rf double-resonance measurements of the hyperfine structure in Sc II. Mansour, N. B. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439(US)); Dinneen, T.; Young, L.; Cheng, K. T. *Physical Review [Section] A: General Physics (USA),* 39(11): 5762-5767 (1 Jun 1989). DOE Contract W-31-109-ENG-38.

The hyperfine structure of all levels of the metastable $3d^2$ configuration in Sc ii has been measured with high precision by collinear fast-ion laser-rf double-resonance spectroscopy. The double-resonance technique improved the precision of the earlier results by more than a factor of 150. The enhanced precision made possible for the first time a meaningful comparison between experimental and multiconfiguration Dirac-Fock calculated *B* values. The comparison showed that, unlike the *A* values where disagreements between experiment and theory could be greater than 400%, the *B* values were well predicted.

32522 Problems associated with the measurement of coherence parameters: Superelastic electron scattering by laser-excited ^{138}Ba(...6*s*6*p* $^1P_1$) atoms. Zetner, P. W. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109(US)); Trajmar, S.; Csanak, G.; Clark, R. E. H. *Physical Review [Section] A: General Physics (USA),* 39(11): 6022-6025 (1 Jun 1989).

Measurements of superelastic scattering of electrons by laser-excited ^{138}Ba(. . .6*s*6*p* $^1P_1$) atoms were carried out. An asymmetry observed by us and previously by Register *et al.* [Phys. Rev. A 28, 151 (1983)] has been explained using a model of scattering from a target with finite dimensions. This model employed coherence parameters which we calculated in the distorted-wave approximation. The results indicated that the interpretation of coherence experiments in terms of scattering from a pointlike target can lead to serious errors in the deduction of coherence parameters at low scattering angles.

32523 Resonant transfer and excitation in collisions of Li-like F^{6+} and Ca^{17+} with light targets. Bhalla, C. P. (Kansas State University, Department of Physics, Cardwell Hall, Manhattan, Kansas 66506(US)); Karim, K. R. *Physical Review [Section] A: General Physics (USA),* 39(11): 6060-6063 (1 Jun 1989).

Theoretical cross sections for resonant transfer and excitation followed by a stabilizing radiative transition are compared with experimental data for F^{6+}+H_2, Ca^{17+}+H_2, and Ca^{17+}+He collisions. Extensive calculations of radiative and nonradiative rates were performed with the Hartree-Fock atomic model for Be-like fluorine and calcium. The energy dependence and the main features of the experimental data are explained well by our calculations in the impulse approximation. The calculated and experimental absolute cross sections are also in agreement within the quoted experimental uncertainties.

32524 Strong potential wave functions with elastic channel distortion. Macek, J. (University of Tennessee, Knoxville, Tennessee 37996(US)); Taulbjerg, K. *Physical Review [Section] A: General Physics (USA),* 39(11): 6064-6067 (1 Jun 1989). DOE Contract AC05-84OR21400.

The strong-potential Born approximation is analyzed in a channel-distorted-wave approach. Channel-distorted SPB wave functions are reduced to a conventional form in which the standard off-energy-shell factor g has been replaced by a modified factor γ, which represents a suitable average of g over the momentum distribution of the distorted-channel function. The modified factor is evaluated in a physically realistic model for the distortion potential, and it is found that γ is well represented by a slowly varying phase factor. The channel-distorted SPB approximation is accordingly identical to the impulse approximation if the phase variation of γ can be ignored. This is generally the case in applications to radiative electron capture and to a good approximation for ordinary capture at not too small velocities.

32525 Observation of multiphoton detachment of the H^- ion. Tang, C. Y. (The University of New Mexico, Albuquerque, New Mexico 87131(US)); Harris, P. G.; Mohagheghi, A. H.; Bryant, H. C.; Quick, C. R.; Donahue, J. B.; Reeder, R. A.; Cohen, S.; Smith, W. W.; Stewart, J. E.; and others. *Physical Review [Section] A: General Physics (USA),* 39(11): 6068-6071 (1 Jun 1989). DOE Contract AS04-77ER03998.

We have observed nonresonant multiphoton electron detachment of H^- ions in moderately intense (a few tens of GW/cm^2) laser fields. A well-collimated beam of H^- ions with an energy of 581 MeV was intersected by focused 10.6-μm radiation from a pulsed CO_2 laser. The center-of-mass photon energy was tuned using the relativistic Doppler shift so that the minimum number of simultaneous photons required for electron detachment ranged from three to sixteen. Definite signals were observed for the minimum photon number ranging from three to eight. Our preliminary results show evidence for structure in the relative total cross section.

32526 Formation of the negative muonium ion and charge-exchange processes for positive muons passing through thin metal foils. Kuang, Y. (Yale University, New Haven, Connecticut 06511(US)); Arnold, K.; Chmely, F.; Eckhause, M.; Hughes, V. W.; Kane, J. R.; Kettell, S.; Kim, D.; Kumar, K.; Lu, D. C.; and others. *Physical Review [Section] A: General Physics (USA),* 39(12): 6109-6123 (15 Jun 1989).

The negative muonium ion,$Mu^- \equiv \mu^+e^-e^-$, has been produced bydouble electron pickup as a beam of positive muons passes through thin foils ofvarious materials. The Mu^- ions were detected byelectrostatically accelerating and analyzing the ions in a magnetictime-of-flight spectrometer. Yields of Mu^-, Mu andμ^+ as

well are reported when μ^+ with kineticenergies from 380 to 800 keV impinge on thin Be, Al, and Au foils. A MonteCarlo simulation provides good agreement with the experimental results.

32527 **Dielectronic recombination of P^{5+} and Cl^{7+} in configuration-average, *LS*-coupling, and intermediate-coupling approximations.** Badnell, N. R. (Department of Physics, Auburn University, Auburn, Alabama 36849-5311(US)); Pindzola, M. S. *Physical Review [Section] A: General Physics (USA),* 39(12): 6165-6169 (15 Jun 1989).

We have calculated dielectronic recombination cross sections and ratecoefficients for the Ne-like ions P^{5+} and Cl^{7+}in configuration-average, *LS*-coupling, and intermediate-couplingapproximations. Autoionization into excited states reduces the cross sectionsand rate coefficients by substantial amounts in all three methods. There isonly rough agreement between the configuration-average cross-section resultsand the corresponding intermediate-coupling results. There is good agreement,however, between the *LS*-coupling cross-section results and thecorresponding intermediate-coupling results. The *LS*-coupling andintermediate-coupling rate coefficients agree to better than 5%, while theconfiguration-average rate coefficients are about 30% higher than the other twocoupling methods. External electric field effects, as calculated in theconfiguration-average approximation, are found to be relatively small for thecross sections and completely negligible for the rate coefficients. Finally,the general formula of Burgess was found to overestimate the rate coefficientsby roughly a factor of 5, mainly due to the neglect of autoionization intoexcited states.

32528 **Coster-Kronig yields in silver measured with synchrotron radiation.** Sorensen, S. L. (Department of Physics and Chemical Physics Institute, University of Oregon, Eugene, Oregon 97403(US)); Carr, R.; Schaphorst, S. J.; Whitfield, S. B.; Crasemann, B. *Physical Review [Section] A: General Physics (USA),* 39(12): 6241-6246 (15 Jun 1989). DOE Contract AC03-82ER13000.

The Coster-Kronig transition probabilities f_{ij} for shifting avacancy from the L_i to the L_j subshell of Ag have beenmeasured by differential photoionization of the subshells with synchrotronradiation by observing the intensity of the ensuingL_j-$M_{4,5}M_{4,5}$ Augertransitions. In the course of the analysis, spectator satellites in these Augerspectra were identified. The following Ag Coster-Kronig yields were determined:$f_{23}=0.16\pm0.03$,$f_{12}=0.044\pm0.004$, and$f_{13}=0.61\pm0.05$. While f_{23}agrees very well with relativistic independent-particle calculations by Chen*et al.* [Phys. Rev. A 24, 117 (1981)], $f_{12}$and f_{13} fall below predictions by 35% and 18%, respectively, inqualitative accord with expected many-body effects.

6404 Fluid Physics

Refer also to citation(s) 31596, 31603, 31617, 31657, 31896, 32849

32529 (UCRL–100879) **A second-order projection method for the incompressible Navier Stokes equations on quadrilateral grids.** Bell, J.B.; Solomon, J.M.; Szymczak, W.G. Lawrence Livermore National Lab., CA (USA). Apr 1989. 13p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-8906111–1: 9. American Institute of Aeronautics and Astronautics (AIAA) computational fluid dynamics conference, Buffalo, New York, USA, 14-16 Jun 1989). Order Number DE89010242/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes a second-order projection method for the incompressible Navier-Stokes equations on a logically-rectangular quadrilateral grid. The method uses a second-order fractional step scheme in which one first solves diffusion-convection equations to predict intermediate velocities which are then projected onto the space of divergence-free vector fields. The spatial discretization of the diffusion-convection equations is accomplished by formally transforming the equations to a uniform computational space. The diffusion terms are then discretized using standard finite-difference approximations. The convection terms are discretized using a second-order Godunov method that provides a robust discretization of these terms at high Reynolds number. The projection is approximated using a Galerkin procedure that uses a local basis for discretely divergence-free vector fields. Numerical results are presented illustrating the performance of the method. 13 refs., 5 figs.

32530 (UCRL–100880) **Adaptive mesh refinement on moving quadrilateral grids.** Bell, J.B.; Colella, P.; Trangenstein, J.A.; Welcome, M. Lawrence Livermore National Lab., CA (USA). Apr 1989. 12p. Sponsored by DOD;DOE/ER. DOE Contract W-7405-ENG-48. (CONF-8906111–2: 9. American Institute of Aeronautics and Astronautics (AIAA) computational fluid dynamics conference, Buffalo, New York, USA, 14-16 Jun 1989). Order Number DE89010241/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes an adaptive mesh refinement algorithm for unsteady gas dynamics. The algorithm is based on an unsplit, second-order Godunov integration scheme for logically-rectangular moving quadrilateral grids. The integration scheme is conservative and provides a robust, high resolution discretization of the equations of gas dynamics for problems with strong nonlinearities. The integration scheme is coupled to a local adaptive mesh refinement algorithm that dynamically adjusts the location of refined grid patches to preserve the accuracy of the solution, preserving conservation at interfaces between coarse and fine grids while adjusting the geometry of the fine grids so that grid lines remain smooth under refinement. Numerical results are presented illustrating the performance of the algorithm. 5 refs., 3 figs.

32531 **Domain decomposition algorithms and computational fluid dynamics.** Chan, T.F. (Univ. of California, Los Angeles, Los Angeles, CA (US)). *International Journal of Supercomputer Application (USA),* 2(4): 72-83 (1988).

In the past several years, domain decomposition has been a very popular topic, partly because of the potential of parallelization. Although numerous theories and algorithms have been developed for model elliptic problems, they are only recently starting to be tested on realistic applications. This paper investigates the application of some of these methods to two model problems in computational fluid dynamics: two-dimensional convection-diffusion problems and the incompressible driven cavity flow problem. The authors approach is the construction and analysis of efficient preconditioners for the interface operator to be used in the iterative solution of the interface solution. For the convection-diffusion problems, they discuss the effect of the convection term and its discretization on the performance of some of the preconditioners. For the driven cavity problem, they discuss the effectiveness of a class of boundary probe preconditioners.

32532 **Aerosol particle deposition in numerically simulated channel flow.** McLaughlin, J. B. (Department of Chemical Engineering, Clarkson University, Potsdam, New York 13676(US)). *Physics of Fluids A: Fluid Dynamics (USA),* 1(7): 1211-1224 (Jul 1989).

The trajectories of rigid spherical particles in a turbulent channel floware computed using a pseudospectral computer program to simulate thethree-dimensional, time-dependent flow field. It is assumed that the channel isvertical so that gravity cannot directly cause the deposition of particles onthe walls. The particles are assumed to be sufficiently small and widelyseparated so that their influence on the fluid velocity field can be ignored. Itis found that when the particles are assigned random initial locations withinitial velocities that are equal to the local fluid velocity, the particlestend to accumulate in the viscous sublayer. At the edge of the viscous sublayer,the particles that deposit on the wall typically possess normal components ofvelocity that are comparable in magnitude to the intensity of the normalcomponent of the velocity in the core of the channel (i.e., of the order ofmagnitude of the friction velocity). A shear-induced lift force having the formderived by Saffman for laminar flow is found to have virtually no effect onparticle trajectories, except within the viscous sublayer where it plays asignificant role both in the inertial deposition of particles and in theaccumulation of trapped particles. The Reynolds number of the particles thatdeposit does not remain small compared with unity.

32533 **Modeling two-dimensional detonations with detonation shock dynamics.** Bdzil, J. B. (Los Alamos National Laboratory, Group M-9, Mail Stop P952, Los Alamos, New Mexico 87545(US)); Stewart, D. S. *Physics of Fluids A: Fluid Dynamics (USA),* 1(7): 1261-1267 (Jul 1989).

One of the principal shortcomings of the computer models that are presentlyused for two-dimensional explosive engineering design is their inadequatetreatment of the explosive's detonation reaction

zone. Current methods lack theresolution to both calculate the broad gas expansion region and model the thinreaction zone with reasonable detail. Recently an alternative method formodeling the reaction zone has been developed. This method applies when theradius of curvature of the shock is large compared to the reaction-zone length.In this limit, the dynamics of the interaction between the chemical heat releaseand the two-dimensional flow in the reaction zone is quasisteady. It issummarized by a relation $D_n(\kappa)$, between the local normalshock velocity D_n and shock curvature κ. When this relation iscombined with the kinematic surface condition (an equation that describes howdisturbances move along the shock), the two-dimensional reaction-zonecalculation is reduced to a one-dimensional calculation.

32534 The Pierce diode with an external circuit. I. Oscillations about nonuniform equilibria. Lawson, W. S. (Electronics Research Laboratory, University of California, Berkeley, California 94720(US)). *Physics of Fluids B: Plasma Physics (USA),* 1(7): 1483-1492 (Jul 1989).

The nonuniform (nonlinear) equilibria of the classical (short circuit)Pierce diode and the extended (series RLC external circuit) Pierce diode aredescribed, and the spectrum of oscillations (stable and unstable) about theseequilibria are worked out. It is found that only the external capacitance altersthe equilibria, though all elements alter the spectrum. In particular, theintroduction of an external capacitor destabilizes some equilibria that aremarginally stable without the capacitor. Computer simulations are performed totest the theoretical predictions for the case of an external capacitor only. Itis found that most equilibria are correctly predicted by theory, but that thecontinuous set of equilibria of the classical Pierce diode at Pierce parameters($\alpha=\omega_{pL}/v_0$) that are multiples of 2π are notobserved. This appears to be a failure of the simulation method under the rathersingular conditions rather than a failure of the theory.

32535 The Pierce diode with an external circuit. II. Chaotic behavior. Lawson, W. S. (Electronics Research Laboratory, University of California, Berkeley, California 94720(US)). *Physics of Fluids B: Plasma Physics (USA),* 1(7): 1493-1501 (Jul 1989).

The existence of the strange attractor discovered by Godfrey [Phys. Fluids**30**, 1553 (1987)] in the neighborhood of $\alpha=3\pi$ for the Pierce diode isverified, and his numerical results are refined. The theory of Feigenbaum forthe sequence of period-doubling bifurcations [J. Stat. Phys. **19**, 25(1975)] is tested with good agreement, despite the strong assumptions made bythat theory. The evolution of this attractor is then followed as an externalcapacitance is introduced, producing a family of bifurcation diagrams.Examination of these diagrams produces one result that should be of interest tomathematical physicists: The existence of an unstable equilibrium in theneighborhood of the strange attractor is strongly implicated in both theexistence and destruction of the attractor. The reversibility of the equationsof evolution is also discussed, but no clear-cut conclusion is reached.

32536 Sharp boundary analysis of electrostatic flute modes. Lemons, D. S. (Department of Physics, Bethel College, North Newton, Kansas 67117(US)). *Physics of Fluids B: Plasma Physics (USA),* 1(7): 1539-1541 (Jul 1989).

A linear, electrostatic, stability analysis of a magnetized crossfielddrifting plasma with a sharp boundary is presented. The analysis corrects anerror in a previously published sharp boundary theory [Phys. Fluids **19**,882 (1976)] and extends another theory [Geophys. Res. Lett. **14**, 60(1987)] to include finite electron mass and non-neutral perturbations. Theinstability's long wavelength structure is associated with the classical fluteinstability, while the peak of the growth rate curve, at much shorterwavelengths, is a Buneman-like instability.

32537 Analytic expression for mode conversion of Langmuir and electromagnetic waves. Hinkel-Lipsker, D. E. (Department of Physics, University of California, Los Angeles, Los Angeles, California 90024-1547(US)); Fried, B. D.; Morales, G. J. *Physical Review Letters (USA),* 62(23): 2680-2682 (5 Jun 1989).

We have derived analytic expressions, in terms of Airy functions, for thereflection and mode-conversion coefficients of Langmuir and electromagneticwaves in an inhomogeneous, unmagnetized plasma. The reflection coefficient forthe "direct" problem (incident electromagnetic wave) is equal in magnitude tothat for the "inverse" problem (incident electrostatic wave) and thecorresponding mode-conversion coefficients satisfy energy conservation. Ourresults, which are valid in the limit of nonrelativistic electron temperature, $T/mc^2 \ll 1$, agree with earlier numerical calculations.

32538 Formation of double layers within an oblique collisionless shock. Lembege, B. (Department of Physics, University of California, Los Angeles, California 90024-1547(US)); Dawson, J. M. *Physical Review Letters (USA),* 62(23): 2683-2686 (5 Jun 1989).

Simulations show that for shock waves propagating obliquely to a magneticfield (angles from 55° to 80° for the parameters run), a double layer formsat the shock front and plays an important role in the shock dynamics. Electronsare strongly accelerated through the double layer and scattered off ion andmagnetic field fluctuations behind the shock. Some ions are reflected by thedouble layer and the jump in magnetic field. For these investigations, electronheating is the major dissipation.

32539 Vortex turbulence generated by second sound in superfluid ^{4}He. Kotsubo, V. (Condensed Matter and Thermal Physics Group, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Swift, G. W. *Physical Review Letters (USA),* 62(22): 2604-2607 (29 May 1989).

Vortex turbulence generated by high-amplitude second sound in superfluid ^{4}He is observed. Features of the transition to turbulence are similar to those seen in dc superfluid flow experiments. The measured frequency dependence of the critical velocity agrees with the predictions of dynamic scaling theory. The measured temperature dependence is similar to that of dc counterflow.

32540 Do steady fast magnetic dynamos exist?. Finn, J. M. (Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742(US)); Hanson, J. D.; Kan, I.; Ott, E. *Physical Review Letters (USA),* 62(25): 2965-2968 (19 Jun 1989).

The question of whether it is possible to have a kinematic magnetic dynamofor a conducting fluid with time-independent (steady) velocity fieldv(x) and vanishingly small electrical resistivity has remained anopen question in the understanding of the origin of magnetic fields in nature.By considering the zero resistivity dynamics, examples of steady dynamos arefound. Analysis of these examples supports the conjecture that, forsufficiently small resistivity, 2 dynamo action can occur in typical,smooth, steady, three-dimensional, chaotic fluid flows.

32541 Extension of Landau-Ginzburg free-energy functionals to high-gradient domains. Rosenau, P. (Department of Mechanical Engineering, Technion, Haifa 32000, Israel(IL)). *Physical Review [Section] A: General Physics (USA),* 39(12): 6614-6617 (15 Jun 1989).

The Landau-Ginzburg (LG) free-energy-gradient theory is extended to accountfor domains of intermediate wavelengths. The extension is nonlocal butpreserves the universal features of the LG theory, has the same level ofcomplexity, and reduces to it in the small-gradient limit. It also enables oneto gain a meaningful insight into the microstructure of a system.

6450 High Energy Physics

Refer also to citation(s) 31855, 32650

32542 (BNL–34518) **AGS experiments, 1986, 1987, 1988.** Depken, J.C. Brookhaven National Lab., Upton, NY (USA). Apr 1988. 138p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89013211/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This report contains the following on Brookhaven AGS: experimental areas layout; table of beam parameters and fluxes; experiment schedule "as run"; experiment long range schedule; a listing of experiments by number; two-page summaries of each experiment begin here, also ordered by number; publications of AGS experiments, 1982–1988; and alphabetical listing of experimenters.

32543 (DOE/ER/02220–1) **Problems in particle theory: Progress report, April 30, 1988–April 30, 1989.** Wilczek, F.; Adler, S.L. Institute for Advanced Study, Princeton, NJ (USA). 1989. 22p.

Sponsored by DOE Energy Research. DOE Contract AC02-76ER02220. Order Number DE89013603/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Funds are requested for the support of members of The Institute for Advanced Study working on problems in high energy theory. The specific problems to be investigated, which will depend strongly on the particular individuals supported, are expected to cover a variety of topics in particle theory and quantum field theory.

32544 (FNAL/C–89/70) **$\bar{p}p$ collider physics.** Green, D. Fermi National Accelerator Lab., Batavia, IL (USA). Mar 1989. 119p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8901128–1: 5. Jorge Andre Swieca summer school: particles and fields, Sao Paulo, Brazil, 8-21 Jan 1989). Order Number DE89012372/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This note encompasses a set of six lectures given at the summer school held at Campos Do Jordao in January of 1989 near Sao Paulo, Brazil. The intent of the lectures was to describe the physics of $\bar{p}p$ at CERN and Fermilab. Particular attention has been paid to making a self contained presentation to a prospective audience of graduate students. Since large Monte Carlo codes might not be available to all members of this audience, great reliance was placed on "back of the envelope estimates." Emphasis was also placed on experimental data rather than theoretical speculation, since predictions for, for example, supersymmetric particle production are easily obtained by transcription of formulae already obtained. 9 refs., 67 figs., 2 tabs.

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 31704, 31801, 32470, 32659

32545 (BNL–42535) **Search for violation of time reversal invariance in $K_{\mu 3}$ decays.** Morse, W.M. Brookhaven National Lab., Upton, NY (USA). 1988. 5p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8811209–1: CP violation at KAON Factory, Vancouver, Canada, 30 Nov - 3 dec 1988). Order Number DE89011877/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Measurements of the T invariance violating transverse polarization in $K_{\mu 3}$ decays are reviewed. Suggestions are made on possible improvements. 1 ref., 2 figs.

32546 (CONF-8809223–7) **LAMPF E645/current status.** Freedman, S.J. Argonne National Lab., IL (USA). 1988. 8p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Workshop on new directions in neutrino physics; Batavia, Illinois, USA; 14-16 Sep 1988. Order Number DE89013631/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Experiment E645 at LAMPF is a search for $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$ oscillations using the proton beamstop as a neutrino source. The apparatus is a 20-ton neutrino detector and a cosmic-ray anticoincidence shield $\simeq$26 m from the beamstop. No evidence for neutrino oscillations was found in the first year of data taking. The experiment is described and the limits on neutrino oscillation parameters from the data collected during 1987 are presented. 6 refs., 3 figs.

32547 (INIS-mf–11958) **Observation of CHI/sub b/and CHI/sub b/' production in exclusive decays of the Υ' and Υ'' with the CUSB detector at the Cornell e/sup +/e/sup -/storage ring.** Eigen, G. Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik. 23 Nov 1984. 212p. Order Number DE89774795/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

The nonmagnetic CUSB detector at the Cornell Electron Storage Ring (CESR) has been used to study both the exclusive cascade decays TAU'->γCHI/sub b/->$\gamma\gamma$TAU->$\gamma\gamma$(μ/sup +/μ/sup -/or e/sup +/e/sup -/), TAU"->γCHI/sub b/"->$\gamma\gamma$TAU'->$\gamma\gamma$(μ/sup +/μ/sup -/or e/sup +/e/sup -/), TAU'->γCHI/sub b/"->$\gamma\gamma$TAU->$\gamma\gamma$(μ/sup +/μ/sup -/or e/sup +/e/sup -/) and the inclusive photon spectra from radiative TAU' and TAU" decays. In a data sample of $\simeq$ 170,000 TAU' resonance decays and $\simeq$ 50,000 TAU" resonance decays evidence for CHI/sub b/and CHI/sub b/' production has been found in both analyses. From the line positions in the photon spectra the CHI/sub b/ masses have been determined to be at M(1/sup 3/P/sub 0/)=(9,873±5) MeV, M(1/sup 3/P/sub 1/)=(9,894±2) MeV and M(1/sup 3/P/sub 2/)=(9,915±2) MeV, the CHI/sub b/' masses at M(2/sup 3/P/sub 0/)=(10,233±5) MeV, M(2/sup 3/P/sub 1/)=(10,256±2) MeV and M(2/sup 3/P/sub 2/)=(10,271±2) MeV. The spin-averaged center-of-gravities have been obtained at M(1/sup 3/P/sub cog/)=(9,904±1.5) MeV and M(2/sup 3/P/sub cog/)=(10,262±1.5) MeV. The product branching ratios for the three exclusive decay modes are (3.2±0.7)%, (5.0±2.1)% and (3.6±1.1)%, respectively. For the inclusive transitions TAU'->γCHI/sub b/and TAU"->γCHI/sub b/', branching ratios of (15.5±2.5)% and (35.9±3)% have been measured. The results are in good agreement with predictions of potential models based on perturbative QCD.

32548 (SLAC–342) **A search for close-mass lepton doublet.** Riles, J.K. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Apr 1989. 147p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE89012827/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Described is a search for a heavy charged lepton with an associated neutrino of nearly the same mass, together known as a close-mass lepton doublet. The search is conducted in e^+e^- annihilation data taken with the Mark II detector at a center-of-mass energy of 29 GeV. In order to suppress contamination from conventional two-photon reactions, the search applies a novel, radiative-tagging technique. Requiring the presence of an isolated, energetic photon allows exploration for lepton doublets with a mass splitting smaller than that previously accessible to experiment. No evidence for such a new lepton has been found, enabling limits to be placed on allowed mass combinations. Mass differences as low as 250-300 MeV are excluded for charged lepton masses up to 10 GeV. 78 refs., 64 figs., 8 tabs.

32549 (SLAC-PUB–4821) **Recent results on S = −3 baryon spectroscopy from the LASS [Large Aperture Superconducting Solenoid] spectrometer.** Aston, D.; Awaji, N.; Bienz, T.; Bird, F.; D'Amore, J.; Dunwoodie, W.; Endorf, R.; Fujii, K.; Hayashiii, H.; Iwata, S. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Feb 1989. 33p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-880747–6: 16. annual SLAC summer institute on particles physics, Stanford, California, USA, 18-29 Jul 1988;DPNU–80-50). Order Number DE89011279/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Data demonstrating the existence of two Ω^{*-} resonances produced in K^-p interactions at 11 GeV/c in the LASS spectrometer are presented. The first state is seen in the $\Xi^{*0}\pi^-$ decay channel with mass 2253 ± 13 MeV/c^2 and width 81 ± 38 MeV/c^2, and the second in the $\Omega^-\pi^+\pi^-$ system with mass 2474 ± 12 and width 72 ± 33 MeV/c^2. Inclusive cross sections corresponding to these decays corrected for unseen charge modes are estimated to be respectively 630 ± 180 and 290 ± 90 nb, respectively. 10 refs., 16 figs., 1 tab.

32550 **Glueballs in 2^{++} $\phi\phi$ final states.** Lindenbaum, S. J. (Brookhaven National Laboratory and City College of New York(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 68-87 (25 Apr 1989). DOE Contract AC02-76CH00016;AC02-83ER40107. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

In this paper we discuss the striking evidence obtained by BNL/CCNY[1--2] for the $g_T(2010)$, $g_T'(2300)$ and $g_T''(2340)$ $IGuGJ^{PC}=0+2^{++}$ resonances which comprise virtually all of the $\pi^-p \rightarrow \phi\phi n$. The complete breakdown of the expected OZI suppression, and the striking differences of these states from conventional states and background in other channels has so far only been successfully explained by assuming they are produced by 1–3 2^{++} glueballs. The comparison with J/ψ radiative decay results is made. A discussion of other glueball candidates in the light of a coupled channel analysis of the 2^{++} and 0^{++} channels is also made. The forthcoming search for an exotic J^{PC} glueball is discussed.

32551 **The spectroscopy of mesons containing strange quarks.** Aston, D. (Stanford Linear Accelerator Center, Stanford University(US)); Awaji, N.; Bienz, T.; Bird, F.; D'Amore, J.; Dunwoodie, W.; Endorf, R.; Fujii, K.; Hayashii, H.; Iwata, S.; and others.

AIP (American Institute of Physics) Conference Proceedings (USA), 185(1): 160-170 (25 Apr 1989). DOE Contract AC03-76SF00515. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

Recent results from a high statistics study with LASS of mesons which contain strange quarks are reviewed, and compared with the quark model.

32552 *E/ι* **in hadroproduction.** Zieminska, D. (Physics Department, Indiana University, Bloomington, Indiana 47405(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 112-122 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

A review is presented of new experimental results on the *E/ι* meson from hadronic experiments. The possibility that there is more than one pseudoscalar state under iota is discussed.

32553 The search for scalar mesons. Pennington, M. R. (Physics Department, Brookhaven National Laboratory, Upton, NY 11973 and University of Durham, Durham DH1 3LE, U.K.(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 145-159 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

The search for I=0 0^{++} mesons is described. We highlight the crucial role played by the states in the 1 GeV region. An analysis program that with unimpeachable data would produce definitive results on these is outlined and shown with present data to provide *prima facie* evidence for dynamics beyond that of the quark model. We briefly speculate on the current status of the lowest mass scalar mesons and discuss how experiment can resolve the unanswered issues.

32554 Resonance formation in photon-photon collisions. Gidal, G. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 171-184 (25 Apr 1989). DOE Contract AC03-76SF00098. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

Recent experimental progress on resonance formation in photon-photon collisions is reviewed with particular emphasis on the pseudoscalar and tensor nonets and on the $\gamma\gamma^*$ production of spin-one resonances.

32555 Exotic mesons in $\bar{N}N$ annihilation. Dover, C. B. (Brookhaven National Laboratory, Upton, New York 11973(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 251-260 (25 Apr 1989). DOE Contract AC02-76CH00016. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

We investigate the utility of the antinucleon–nucleon ($\bar{N}N$) annihilation process as a means of producing exotic (non $\bar{Q}Q$) mesons. Several examples are considered of J^{PC} exotic formation in the $\bar{p}p \rightarrow \pi X$ reaction. We emphasize the usefulness of quantum number filtration, achieved by preparing the initial $p\bar{p}$ atom in tagged L=0, 1 states and focusing on selected exclusive final states.

32556 Prospects for B physics spectroscopy in Fermilab fixed target experiments. Cox, B. (University of Virginia, Charlottesville, VA 22901, and Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, IL 60510(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 228-245 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

A variety of experimental proposals have been made to attempt to study B physics in Fermilab fixed target experiments. While these experiments must overcone formidable experimental hurdles, they present intriguing opportunities to accumulate much larger samples of reconstruction B decays than have hitherto been available. A brief evaluation of the prospects for the approved Fermilab TEV II experiments which plan to attempt this sort of experiment is given in this paper.

32557 Hadroproduction of the iota meson observed in the $K_sK_s\pi^0$ final state. Cason, N. M. (University of Notre Dame, Notre Dame, IN 46556(US)); Bensinger, J. R.; Bishop, J. M.; Biswas, N. N.; Busenitz, J. K.; Etkin, A.; Foley, K. J.; Fortner, M. R.; Fortney, L. R.; Goo, J.; and others. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 334-339 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

Results from an experiment studying the C=+1 $K_sK_s\pi^0$ system produced in π^-p interactions at 21.4 GeV/c are presented. It is shown that the structure present in the data between 1.4 and 1.5 GeV/c^2 has mass and width consistent with the $\iota(1460)$ observed in J/Ψ radiative decay and most probably has $J^{PC}=0^{-+}$.

32558 The strangeonium spectrum seen in Lass; implications for glueball spectroscopy. Aston, D. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309(US)); Awaji, N.; Bienz, T.; Bird, F.; D'Amore, J.; Dunwoodie, W.; Endorf, R.; Fujii, K.; Hayashii, H.; Iwata, S.; and others. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 350-355 (25 Apr 1989). DOE Contract AC03-76SF00515. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

The status of strangeonium spectroscopy is re–assessed following our recent high statistics study of K^- induced hypercharge exchange reactions. The implications of our results for the status of glueball, or otherwise exotic, candidates observed in the same decay modes but produced by different mechanisms are also discussed.

32559 Mass dependent fits of the partial wave analysis of the $K^+\bar{K}0\pi-$ system. Blessing, S. (Physics Department, Indiana University, Bloomington, Indiana 47405(US)); Crittenden, R.; Dzierba, A.; Marshall, T.; Teige, S.; Zieminska, D.; Birman, A.; Chung, S. U.; Peaslee, D.; Fernow, R.; and others. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 363-372 (25 Apr 1989). DOE Contract AC02-84ER40125;AC02-76CH00016;FG05-87ER40319. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988). We have performed a partial wave analysis of the $K^+K0_S\pi^-$ system produced in the reaction $\pi^-p \rightarrow K^+\bar{K}0\pi-n$ at GeV/c. We present the mass dependent fits to the PWA results for the waves J^{PG}(isobar)=$0^{-+}(a_0)$, $0^{-+}(K^*)$, $1^{++}(a_0)$ and $1^{++}(K^*)$.

32560 Primakoff production of hybrid mesons. Zielinski, M. (University of Rochester, Rochester, NY 14627(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 395-399 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

The viability of Primakoff technique in searching for hybrid states, and exotic $J^{PC}=1^{-+}$ isovector meson $\tilde{\rho}$ in particular, is discussed. Results of searches for Primakoff production of an $\tilde{\rho}$ in $\rho\pi$ and $\eta\pi$ final states produced in high energy interactions of pions with large-Z nuclei are reviewed, and the limits for the radiative coupling $\Gamma(\tilde{\rho}^+ \rightarrow \pi+\gamma)$ are presented. Based on available experimental information, electromagnetic production rate estimates are given for the favored $\tilde{\rho} \rightarrow \pi f_1(1285)$ channel. It is argued that a dedicated Primakoff production experiment can be sensitive to values of $\Gamma(\tilde{\rho}^+ \rightarrow \pi+\gamma)\sim$keV, which makes such measurement a very interesting option for doing spectroscopy of gluonic (and conventional) meson states in the 1.5∼3 GeV mass range.

32561 Some preliminary results from BNL E766 on pp−→pp K_s^0 Kπ. Hartouni, E. P. (University of Massachusetts, Amherst, Massachusetts 01003(US)); Jensen, D.; Klima, B.; Kreisler, M.; Rabin, M.; Uribe, J.; Church, M.; Knapp, B.; Gottschalk, E.; Sippach, W.; and others. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 408-412 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

This brief talk will present the very preliminary results of an ongoing data analysis of the data from BNL E766. BNL E766 was an experiment to study heavy particle spectroscopy in np(15–24 GeV)

and pp interactions (28 GeV). The following discussion pertains to the pp → ppK$_s$°Kπ run. (AIP)

32562 Two-photon formation of spin-one resonances and the nature of the *E*(1420). Caldwell, D. O. (University of California, Santa Barbara, CA 93106(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 465-471 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

A powerful new tool in meson spectroscopy has become available with the recent observation of two spin-one mesons produced by the interaction of one nearly real and one highly virtual photon. The first of these mesons, detected initially by the TPC/2γ collaboration and confirmed by the Mark II, JADE, and CELLO collaborations using the reaction $\gamma\gamma^* \rightarrow X(1420) \rightarrow K^{\pm}\, K^0{}_s\pi^{\pm}$, is almost surely not a $\overline{qq}$ state. It has a mass, width, and $K^*(892)K$ decay like the E(1420) observed in hadronic reactions and reported variously as 0^- and 1^+. Its observation with $\gamma\gamma^*$ (single-tagged) and not with $\gamma\gamma$ (untagged) shows it to be spin one. To calibrate this observation, a known spin-one state, the $J^{PC}=1^{++}$ $f_1(1285)$, or D, was observed in the state $\eta\pi^+\pi-$ by the same experimental groups. The two-photon widths of these two mesons are not consistent with their both being in the ground-state axial vector nonet, and there are many reasons why the E is not that mainly $\overline{ss}$ state. It is likely to be a four-quark state, probably as a K^*K molecule.

32563 Vector-vector production in photon-photon interactions. Ronan, M. T. (Lawrence Berkeley Laboratory, University of California, Berkeley(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 494-500 (25 Apr 1989). DOE Contract AC03-76SF00098. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

Measurements of exclusive untagged $\rho^0\rho0, \rho\phi, K^*K^{-+}$, and $\rho\omega$ production and tagged $\rho^0\rho0$ production in photon-photon interactions by the TPC/Two-Gamma experiment are reviewed. Comparisons to the results of other experiments and to models of vector-vector production are made. Fits to the data following a four quark model prescription for vector meson pair production are also presented.

32564 Preliminary results of $\bar{p}p$ at 8 GeV/*c*. Boehnlein, A. (Physics Department, Florida State University, Tallahassee, Florida 32306(US)); Boehnlein, D.; Goldman, J. H.; Hagopian, V.; Birman, A.; Chung, S. U.; Peaslee, D.; Fernow, R.; Kirk, H.; Protopopescu, S. D.; and others. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 446-451 (25 Apr 1989). DOE Contract FG05-87ER40319;AC02-84ER40125;AC02-76CH00016;AS05-(CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

We are studying the reaction $\bar{p}p \rightarrow K^+\bar{K}^0\pi-X$ and $pp \rightarrow \bar{\Lambda}p\pi\ X$. We present mass spectra for the systems produced in these reactions. The data represent one-half of the total data collected.

32565 Peaks in the valley: Searching for resonances in large angle exclusive scattering. Carroll, A. S. (Alternating Gradient Synchrotron Department, Brookhaven National Laboratory, Upton, New York 11973(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 451-458 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

The problem we pose for this talk is how to find high mass, relatively broad width, low spin resonances in the midst of very large diffractive backgrounds in hadronic interactions. One possible answer is to study large angle exclusive scattering where the forward diffraction has gone away and the background is small. Moreover, this background may be partially understood in the context of perturbative Quantum Chromodynamics (pQCD). In this talk, we describe results from AGS Experiment 834. (AIP)

32566 Search for A J^{PC} exotic hybrid meson. Chung, S. U. (Brookhaven National Laboratory, Upton, New York 11973(US)); Fernow, R.; Kirk, H.; Protopopescu, S. D.; Willutzki, H.; Crittenden, R.; Dzierba, A.; Marshall, T.; Zieminska, D.; Bonner, B. E.; and others. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 631-635 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

This paper describes an experiment that will search for J^{PC} hybrid mesons at the Brookhaven MPS-II facility. Such explicitly exotic states are allowed in QCD, and are predicted to be in an accessible mass region by several models. The experiment will investigate the production of exotics in the reaction $\pi^-p \rightarrow \pi-f_1p$. Expected rates and experimental sensitivity to possible hybrid states are discussed.

32567 Future opportunities for hadron spectroscopy at the MPS. Longacre, R. S. (Brookhaven National Laboratory, Upton, New York 11973(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 670-677 (25 Apr 1989). DOE Contract AC02-76CH00016. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

MPS hadron spectroscopy results and proposals with $K^-p \rightarrow K_sK_sA^o(\Sigma^o)$, anti$-pp \rightarrow K_sK_sX, K_sK_s\pi^o$, and low energy $\pi\pi$scattering for glueballs are reviewed. And a summary of the status of latticegauge calculations of glueball masses plus glueball and hybrid masses from thebag model, and the flux tube model is given. (AIP)

32568 Summary of the hybrids and exotics sessions. Godfrey, S. (Guelph-Waterloo Program for Graduate Work in Physics, Department of Physics, University of Guelph, Guelph, CANADA N1G 2W1(CA)); Willutzki, H. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 703-719 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

We summarize the Hybrids, Exotics, and Dibaryon section. We begin with a brief discussion of hybrid properties and some comments on $\overline{qq}q\overline{q}$ states and dibaryons. The bulk of this summary is devoted to discussion of the interesting results report in these sessions; the GAMS1$^{-+} \rightarrow \eta\pi^0$ state, the Lepton-F $C(1480) \rightarrow \phi\pi^0$ state, various$\gamma\gamma \rightarrow VV$ results, and the CERN WA62 $U(3.1) \rightarrow \Lambda\bar{p}\pi^+\pi-$ state along with theoretical interpretations of these results. We conclude with some comments on future directions in exotic hadrons.

32569 Determination of $\sin^2\theta_W$ from measurements of differential cross sections for muon-neutrino and -antineutrino scattering by electrons. Abe, K. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973(US)); Ahrens, L. A.; Amako, K.; Aronson, S. H.; Beier, E. W.; Callas, J. L.; Cutts, D.; Diwan, M. V.; Durkin, L. S.; Gibbard, B. G.; and others. *Physical Review Letters (USA),* 62(15): 1709-1712 (10 Apr 1989).

Measurements of the combined differential cross sections $d\sigma/dy$for ν_μ and $\bar{\nu}_\mu$ scattering by electrons yield the value $\sin^2\theta_W=0.195\pm0.018\pm0.013$. This value, at $Q^2\cong1\times10^{-3}(\text{GeV}/c)^2$, is more precise than and in good agreement with our determination from the ratio of the total cross sections for the same reaction. It is consistent with, but lower than, the value determined from deep-inelastic neutrino scattering.

32570 Experimental evidence for the non-Abelian nature of QCD from a study of multijet events produced in e^+e^- annihilation. Park, I. H. (Rutgers University, Piscataway, New Jersey 08854(US)); Schnetzer, S.; Green, J.; Sakamoto, S.; Sannes, F.; Stone, R.; Trentalange, S.; Vinson, J.; Bacala, A.; Imlay, R.; and others. *Physical Review Letters (USA),* 62(15): 1713-1716 (10 Apr 1989).

We present evidence for the non-Abelian nature of QCD from a study ofmultijet events produced in e^+e^- annihilations from$\sqrt{s}$ =50 to 57 GeV in the AMY detector at the KEK storage ring TRISTAN. Acomparison of the three-jet event fraction at TRISTAN to the fraction of theDESY storage ring PETRA shows that the QCD coupling strength $\alpha_s$decreases with increasing Q^2. In addition, measurements of theangular distributions of four-jet events show evidence for the triple-gluonvertex.

32571 Observation of excited charmed mesons. Anjos, J. C. (University of California, Santa Barbara, California 93106(US)); Appel, J. A.; Bean, A.; Bracker, S. B.; Browder, T. E.; Cremaldi, L. M.; Elliott, J. R.; Escobar, C. O.; Estabrooks, P.; Gibney, M. C.; and others. *Physical Review Letters (USA),* 62(15): 1717-1720 (10 Apr 1989).

Using the Tagged Photon Spectrometer and a high-energy photon beam, we havesearched for excited states of charm in Fermilab experiment E691. We have foundevidence for a state of mass 2459±3 (stat.) ±2 (syst.)MeV/c^2 and width 20±10±5 MeV/c^2which decays to $D^+\pi^-$. The fraction of D^+coming from D^{*0}(2459) is 0.07±0.02±0.02. Wealso confirm the$D^{*0}(2420)\rightarrow D^{*+}\pi^-$ decayobserved previously in e^+e^- experiments and presentevidence for its charged counterpart.

32572 Observation of $\Sigma_c^0\rightarrow\Lambda_c^+\pi^-$ decays. Anjos, J. C. (University of California, Santa Barbara, Santa Barbara, California 93106(US)); Appel, J. A.; Bean, A.; Bracker, S. B.; Browder, T. E.; Cremaldi, L. M.; Elliott, J. R.; Escobar, C. O.; Estabrooks, P.; Gibney, M. C.; and others. *Physical Review Letters (USA),* 62(15): 1721-1723 (10 Apr 1989).

Using a sample of approximately 120$\Lambda_c^+\rightarrow pK^-\pi^+$ decays reconstructedin photoproduction experiment E691 at Fermilab, we have searched forΣ_c production and decay into $\Lambda_c\pi$. A signal of14±4 Σ_c^0 decays is observed. TheΣ_c^0-Λ_c^+ mass difference is measuredto be 168.4±1.0±0.3 MeV/c^2. We also report on therelative fraction of Σ_c production as compared to inclusiveΛ_c production at an average photon energy of 145 GeV.

32573 Search for $b\rightarrow u$ transitions in exclusive hadronic B-meson decays. Bortoletto, D. (Syracuse University, Syracuse, New York 13210(US)); Goldberg, M.; Horwitz, N.; Mestayer, M. D.; Moneti, G. C.; Sharma, V.; Shipsey, I. P. J.; Skwarnicki, T.; Csorna, S. E.; Letson, T.; and others. *Physical Review Letters (USA),* 62(21): 2436-2439 (22 May 1989).

From a data sample of 242 000 $B\bar{B}$ pairs collected with the CLEOdetector at the $\Upsilon(4S)$ resonance, we set upper limits for thebranching ratios for exclusive hadronic decays of B mesons arising from$b\rightarrow u$ transitions. Model-dependent limits for the ratio of theKobayashi-Maskawa matrix elements V_{ub}/V_{cb} are presented.

32574 Λ_c^+ production and semileptonic decay in 29-GeV e^+e^- annihilation. Klein, S. R. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94309(US)); Himel, T.; Abrams, G.; Amidei, D.; Baden, A. R.; Barklow, T.; Boyarski, A. M.; Boyer, J.; Burchat, P. R.; Burke, D. L.; and others. *Physical Review Letters (USA),* 62(21): 2444-2447 (22 May 1989). DOE Contract AC03-76SF00515;AC03-76SF00098;AC02-76ER03064.

We present results on Λ_c^+ production in 29-GeVe^+e^- annihilation. The Λ_c^+ are observed via their semileptonic decays to Λe^+X and$\Lambda\mu^+X$. With radiative corrections, we find $\sigma(e^+e-\rightarrow\Lambda_c^+X))B(\Lambda_c^+\rightarrow e\Lambda X)$= 1.5±0.6±0.5 pb or 0.0038±0.0015±0.0012 $\Lambda_c^+\rightarrow\Lambda e+X$ decay per hadronic event, and $\sigma(e^+e-\Lambda_c^+X)B(\Lambda_c^+\rightarrow\mu\Lambda X)$= 1.4±1.4±0.4 pb or 0.0035±0.0035±0.0011 $\Lambda_c^+\rightarrow\Lambda\mu+X$ decay per hadronic event. These results can be used to place constraints on the predictions of various production models.

32575 Observation of structures in the mass range of 2700 to 2900 MeV in the difference between the $p\bar{p}$ total cross sections for pure helicity states. Auer, I. P. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439(US)); Colton, E.; Ditzler, W. R.; Halpern, H.; Hill, D.; Miller, R. C.; Spinka, H.; Tamura, N.; Tavernier, J.; Theodosiou, G.; and others. *Physical Review Letters (USA),* 62(23): 2649-2651 (5 Jun 1989). DOE Contract W-31-109-ENG-38.

One decade ago evidence for the formation of diproton resonances was firstreported in the mass range of 2140 to 2220 MeV. Recently structures at muchhigher mass region (2700 to 2900 MeV) were found in various measurements. A new$\Delta\sigma_L$ measurement revealing bumps and a dip is reported here inthis mass region and the nature of the structure is discussed.

32576 Aspects of top-quark searches in TeV hadron collisions. Rosner, J. L. (Institute for Advanced Study, Princeton, New Jersey 08540(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3297-3309 (1 Jun 1989).

The prospect of obtaining a sample of $p\bar{p}$ collisions at $\sqrt{s}$ =1.8 TeV in excess of one event per pb of cross section implies that searches for top quarks up to masses greater than that of the W are of immediate interest. The most sensitive and direct search methods vary considerably as the top-quark mass varies from its present lower limit to masses well above that of the W. Examples are given of several such search methods. Attention is paid to the interplay of the β-decay matrix element and the W propagator for values of $m_t\cong M_W$.

32577 Search for the anomalous production of single photons in e^+e^- annihilation at $\sqrt{s}$ =29 GeV. Hearty, C. (Department of Physics, University of Washington, Seattle, Washington 98195(US)); Rothberg, J. E.; Young, K. K.; Johnson, A. S.; Whitaker, J. S.; Wilson, R. J.; Bartha, G.; Burke, D. L.; Extermann, P.; Garbincius, P. H.; and others. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3207-3226 (1 Jun 1989). DOE Contract AC03-76SF00515.

This paper reports results of a search for production by radiative e^+e^- annihilation of particles that interact only weakly in matter. The search has been made in a data set corresponding to 110 pb^{-1} acquired with the ASP detector at the Stanford Linear Accelerator Center storage ring PEP ($\sqrt{s}$ =29 GeV). No anomalous signal has been observed, which limits the number of generations of light neutrinos to be N_ν<7.9 (at 90% C.L.). Limits are also placed on the masses of particles predicted to exist by models of supersymmetry.

32578 Search for top-quark decays to real W bosons at the Fermilab Tevatron collider. Baer, H. (Physics Department, Florida State University, Tallahassee, Florida 32306(US)); Barger, V.; Phillips, R. J. N. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3310-3321 (1 Jun 1989).

We propose ways in which eventual signals from heavy-top-quark decays into on-shell or nearly-on-shell W bosons may be discriminated more sharply from background at the Fermilab Tevatron $p\bar{p}$ collider. For single-lepton $t\bar{t}$ signals, the principal background from direct W production cannot be eliminated by acceptance cuts alone, but the signal/background ratio can be greatly increased by requiring a high jet multiplicity n. Top-quark signals can be detected and m_t can be measured via enhancements in the single-lepton event rates at high n, or via a peak in the invariant mass of the three hardest jets at high n. A $t\bar{t}$ signal can be extracted up to m_t=150 GeV (180 GeV) from selected data with $n\geq3$ ($n\geq4$) jets. For two-lepton $t\bar{t}$ signals, the principal standard-model backgrounds from $b\bar{b}$, $c\bar{c}$ and Drell-Yan dilepton production can all be removed by cuts. The remaining backgrounds from direct W^+W^- and Drell-Yan $\tau\bar{\tau}$ production can be suppressed to a level well below the $t\bar{t}$ signals, for the whole of the mass range up to m_t=200 GeV allowed for the standard model. Eventual $t\bar{t}$ signals can be confirmed by characteristic dynamical distributions. An integrated luminosity of 10 pb^{-1} (100 pb^{-1}) would be enough to detect top quarks up to m_t=120 GeV (200 GeV).

32579 High-resolution measurement of massive-dielectron production in 800-GeV proton-beryllium collisions. Yoshida, T. (Kyoto University, Kyoto 606, Japan(JP)); Adams, M. R.; Brown, C. N.; Cooper, W. E.; Crittenden, J. A.; Finley, D. A.; Glass, H. D.; Gray, R.; Hemmi, Y.; Hsiung, Y. B.; and others. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3516-3519 (1 Jun 1989).

The hadronic production of dielectrons in the Υ region has beenmeasured with a mass resolution of 0.17% using incident protons with momentumof 800 GeV/c. The cross sections of the Υ resonances are comparedwith the predictions of a gluon-fusion model. The dielectron continuum is alsocompared with the Drell-Yan prediction, and the K factor is extracted.The results on the mean transverse momentum of the resonances and that of thecontinuum are also presented.

6452 Particle Interactions and Properties - Theoretical

Refer also to citation(s) 32470, 32471, 32548, 32559, 32576, 32578, 32626, 32627, 32641, 32644, 32733, 32740, 32744

32580 (BNL–42537) **The search for a heavy Higgs boson.** Dawson, S. Brookhaven National Lab., Upton, NY (USA). Feb 1989. 17p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-8901127–1: Workshop on high energy physics phenomenology, Bombay, India, 2-15 Jan 1989). Order Number

DE89012580/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Theoretical limits on the mass of the Higgs boson from vacuum stability and perturbative unitarity are examined. Search techniques for heavy Higgs bosons, $M_H > 200$ GeV, are also reviewed. 8 refs., 5 figs.

32581 (BNL–42715) **Rare K decays and limits on new forces.** Aronson, S.; Trampetic, J.; Cheng, H.Y.; Fischbach, E.; Talmadge, C. Brookhaven National Lab., Upton, NY (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-890199–4: 8. Moriond workshop on tests of fundamental laws in physics, Les Arcs, France, Jan 1989). Order Number DE89012674/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We reconsider the possible detection of hyperphotons ($\gamma\gamma$) in the decay mode, $K_L \rightarrow \pi^+\pi^-\gamma\gamma$. We find it to have certain advantages over $K^+ \rightarrow \pi^+\gamma\gamma$ in setting limits on new forces coupling to hypercharge. The prospects for studying this decay mode in the near future are discussed. 10 refs.

32582 (DOE/ER/02271–112) **Theoretical high energy physics: Progress report, May 1, 1988–April 30, 1989.** Lee, T.D. Columbia Univ., New York, NY (USA). May 1989. 25p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER02271. (COO–2271-112). Order Number DE89013113/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses theoretical research done in high energy physics at Columbia University. Some of the topics discussed are: conformal field theory; QCD calculations; study of long-range forces; superconductivity; and cosmology. (LSP)

32583 (DOE/ER/40224–64) **Geometrical scaling, furry branching and minijets.** Hwa, R.C. Oregon Univ., Eugene, OR (USA). Jan 1988. 9p. Sponsored by DOE Energy Research. DOE Contract FG06-85ER40224. (OITS–380). Order Number DE89011411/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Scaling properties and their violations in hadronic collisions are discussed in the framework of the geometrical branching model. Geometrical scaling supplemented by Furry branching characterizes the soft component, while the production of jets specifies the hard component. Many features of multiparticle production processes are well described by this model. 21 refs.

32584 (DOE/ER/40235–T5) **Theoretical studies in elementary particle physics: Progress report, March 1988–January 1989.** Collins, J.C. Illinois Inst. of Tech., Chicago, IL (USA). 1989. 20p. Sponsored by DOE Energy Research. DOE Contract FG02-85ER40235. Order Number DE89012701/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report briefly discusses the following topics: factorization, fundamental perturbative QCD; polarization and hard scattering; small x; Drell-Yan phenomenology; cosmic ray physics; cosmic strings and proton decay; dynamical symmetry breaking and inflation; and QCD as a model for mesons. 17 refs. (LSP)

32585 (HEPI–88-05) **On interpretation of the magnetic charge effect on ferromagnetic aerosols.** Mikhajlov, V.F. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 10p. Order Number DE89615712/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

It has been shown tht the magnitude of the magnetic charge observed at submicroparticles in a light beam can be equal or a multiple to the Dirac monopole charge g/sub D/=3.29x10/sup -8/ Gaussxcm/sup 2/. 6 refs.; 2 figs.

32586 (ITP–87-145) **Geometrical model of multiple production.** Chikovani, Z.E.; Jenkovszky, L.L.; Kvaratshelia, T.M.; Struminskij, B.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 11p. Order Number DE89615721/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The relation between geometrical and KNO-scaling and their violation is studied in a geometrical model of multiple production of hadrons. Predictions concerning the behaviour of correlation coefficients at future accelerators are given. 6 refs.; 1 tab.

32587 (ITP–87-167) **Polarized photons from quark-gluon plasma.** Goloviznin, V.V.; Snigirev, A.M.; Zinov'ev, G.M. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 11p. Order Number DE89615713/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The degree of polarization of magnetic bremsstrahlung radiation resulting from the interaction of escaping quarks with a collective confining color field is calculated. For a wide rapidity interval the angle at which the photon is registered and constitutes about 25%. This could signal about quark-gluon plasma formation. 9 refs.; 2 figs.

32588 (ITP–88-9) **Measurement of rho(S)=ReT(S,O)/ImT(S,O) at the collider and its interpretation in a model with odd-c exchange.** Jenkovszky, L.L.; Struminskij, B.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 9p. Order Number DE89615722/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The new value of rho(S) ratio measured recently at $\sqrt{S}$=546 GeV is analysed in a model with odd-C (odderon) exchange. The odderon intercept is larger than unit and a unitarization procedure of amplitude is carried out. Asymptotically, in the forward direction the real part of the odd-C exchange rises, while its imaginary part remains constant. 12 refs.; 1 tab.

32589 (LA-UR–89-1576) **Pion and muon decays beyond the standard model.** Herczeg, P. Los Alamos National Lab., NM (USA). 1988. 38p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8811125–9: Rare decay symposium, Vancouver, Canada, 30 Nov - 3 dec 1988). Order Number DE89013446/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We review and discuss the information provided by charged pion and muon decays on physics beyond the minimal standard model. 109 refs., 3 tabs.

32590 (LUNFD6-TFME–1017-1-11-1988) **Coherence effects in parton showers.** Pettersson, U. Lund Univ. (Sweden). Dept. of Theoretical Physics. Oct 1988. 11p. Order Number DE89612648/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A model for gluon emission based on the colour dipole approximation is presented. Gluons are radiated from dipoles that are stretched from one colour charge to the corresponding anti-charge, with probability distribution given by generalizations of the Altarelli-Parisi equations. The model agrees very well with experimental data on e/sup +/e/sup -/annihilation. For the reaction e/sup +/e/sup -/-> W/sup +/W/sup -/-> qq/sup '/QQ/sup '/it is pointed out how to extract information about the QCD vacuum and the confinement mechanism by varying the CM energy. Finally the model is applied to deep inelastic lepton scattering. When a quark is kicked out in the lepton-proton interaction, separation of the colour charges leads to gluon emission. Since the proton remnant is not a pointlike object, coherence conditions lead to an asymmetry between gluons emitted in the forward and in the backward region. The asymmetry is controlled by the energy distribution in the force field. Experimental data are reproduced with a linear energy distribution, which is consistent with the proton behaving as a vortex line in a type II superconductor.

32591 (NBI-HE–89-01) **Random dynamics and relations between the number of fermion generations and the fine structure.** Nielsen, H.B. Niels Bohr Inst., Copenhagen (Denmark). Jan 1989. 50p. (CONF-8804186–: 23. Zakopane school on physics, Zakopane, Poland, 16-23 Apr 1988). Order Number DE89775044/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

By looking at the structure and crude features of the parameters of the Standard Model we argue for some properties of physics at a more fundamental level, presumably the Planck energy scale. These properties suggest a picture of 'anti-grand-unification' in the sense that, contrary to usual grand unification, we do not expect a simple gauge group at the high energy level. Rather we expect to see a gauge algebra which is a cross product of several simple or abelian factors. A symmetry breaking mechanism called confusion may then break each set of isomorphic factors down to the diagonal

subgroup, thereby explaining the fact that non of the direct product factors in the Standard Model are repeated.

32592 (RAL–89-011) **Fundamentally new physics at the Tevatron Collider?.** Chan Hongmo; Nellen, L.; Tsou Sheungtsun. Rutherford Appleton Lab., Chilton (UK). Feb 1989. 9p. Order Number DE89615723/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A new dispersion relation analysis of present pp-bar scattering data suggests the existence by Tevatron Collider energies of a threshold, of such nature, as is unlikely to be explainable in terms of known physics or any of its standard projections.

32593 Mass ratio m/sub c//m/sub b/in semi-leptonic b-decays. Nir, Y. (Stanford Linear Accelerator Center, CA (USA)). *Physics Letters [Section] B (Netherlands),* 221(2): 184-190 (27 Apr 1989). DOE Contract AC03-76SF00515.

The calculation of the s/sub 23/mixing angle from semi-leptonic B-decay depends on the mass ratio m/sub c//m/sub b/. The energy scales at which the running masses m/sub c/and m/sub b/should be taken are determined once terms of order (α/sub s/(m/sub c//m/sub b/)) are taken into account. We give an analytic expression for the QCD correction to the decay rate to all orders in the ratio between on-shell masses. We explain how it should be modified when both masses are taken at a single common scale.

32594 After-dinner talk—Reminiscences of a particle physicist. Goldhaber, M. (Brookhaven National Laboratory(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 193-199 (25 Apr 1989). DOE Contract AC02-76CH00016. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

Let me recount some of my experiences as a student in the early thirties. During that time there were many great developments in nuclear and cosmic-ray physics, both experimental and theoretical. Some of these are now considered to be part of particle physics, which inherited many of the techniques, results, insights, and styles of research from these older fields. (AIP)

32595 On the identification of θ ($f_2(1720)$) as a tensor glueball. Keh-Fei Liu (University of Kentucky, Lexington, KY 40506(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 310-314 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

The energy-momentum tensor matrix element for the tensor glueball is obtained from the tensor dominance model. Branching ratio of θ ($f_2(1720)$), in J/ψ radiative decay is calculated which agrees with the observed experimental branching ratio. The decay modes of θ ($f_2(1720)$), the suppression of θ in $K^-p \to AK^0_sK^0_s$ as well as its emergence in the central production of $\pi p \to \pi(K^+K^-)p$ and $pp \to p(K^+K^-)p$, and the results from $J/\psi \to \tilde{\gamma}KK$, $\tilde{\omega}KK$, and $\phi\tilde{K}K$ are taken as good indications for flavor independence of the tensor meson θ. Absence of θ ($f_2(1720)$) in $\gamma\gamma$ reaction and $K^-p \to \Lambda K^0_sK^0_s$ are considered as evidence for the fact that there are no quarks in θ. From the combined theoretical and experimental studies, we conclude that θ is indeed a rather pure glueball.

32596 Linear response of hot gluons. Carrington, M. E. (Physics Department, State University of New York, Stony Brook, New York, 11794(US)); Hansson, T. H.; Yamagishi, H.; Zahed, I. *Annals of Physics (New York) (USA),* 190(2): 373-427 (Mar 1989).

We reexamine the various schemes for calculating the linear response(the retarded Green's function) of a hot gluon plasma. The problems relatedto gauge invariance are discussed in detail, and results in differentgauges are compared. We also point out some issues related to the verydefinition of a thermal ensemble in the presence of unphysical degreesof freedom. By calculating the retarded Green's function directly in realtime, we explicitly study the effects of unphysical degrees of freedom indifferent gauges. Although there appears to be no unique way to define theresponse function, we find that several schemes can be questioned on formalgrounds and that use of the background-field gauge (BFG) is the mostsatisfactory in this respect. We discuss two proposals to fix the gaugeparameter (α) dependence in the BFG response function, theVilkovisky–DeWitt effective action corresponding to the choice α=0(background Landau gauge), and the "gauge-invariant propagator" ofCornwall *et al.* corresponding to α=1 (background Feynman gauge).© 1989 Academic Press, Inc.

32597 KK^- **molecules.** Weinstein, J. (University of Tennessee, Knoxville, TN 37996-1200, and ORNL, Oak Ridge, TN 37831(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 400-407 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

We briefly review the history of $qqq\bar{q}\bar{q}$ physics and sketch the Non-Relativistic Quark Model (NRQM). We then outline our analysis of $qqq\bar{q}\bar{q}$ systems in the NRQM and discuss the extraction of meson-meson potentials and their effects on meson-meson systems. We conclude that the $S^*(975)$ and $\delta(980)$ scales are KK^- bound states and show that experiment supports this assignment.

32598 Does the η meson bind to other hadrons?. Rosen, J. L. (Northwestern University, Evanston, IL 60208(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 418-420 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

The constituent quark model has had great success in describing the properties of the basic mesons ($Q\bar{Q}$) and baryons (Q^3). Bound states with larger numbers of valence quarks such as $Q^2\bar{Q}^2$, $Q^3\bar{Q}^3$ and $Q^4\bar{Q}$ have also been predicted. The possibility that the η meson binds to nuclei has been addressed both theoretically and experimentally. An important caveat concerning the composite nature of the η meson is pointed out and discussed.

32599 Inevitable dibaryons. Maltman, K. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Goldman, T.; Stephenson, G. J., Jr.; Schmidt, K. E.; Wang, F. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 413-417 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

Certain qualitative features common to all phenomenological models of hadron structure based on the idea of a separation of perturbative and confinement regimes in QCD necessarily lead to the prediction that, independent of more detailed dynamics, well-defined positive parity channels must support dibaryon resonances. These channels are identified and the qualitative physics underlying this claim discussed. Of these states, only one, with quantum numbers $IJ^P=03^+$, is non-strange. Cross-section estimates are presented for its production in $\pi d \to \pi X$ and $np \to X$.

32600 Exotic mesons. Close, F. E. (Oak Ridge National Laboratory, Oak Ridge, TN 37831-6373, and University of Tennessee, Knoxville, TN 37996-1200(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 421-426 (25 Apr 1989). DOE Contract AC05-84OR21400. (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

I discuss the status of exotic mesons—states that do not fit into the simple $q\bar{q}$ model.

32601 Radiative meson decays—an algebraic approach. Slaughter, M. D. (Mail Stop B283, Medium Energy Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Oneda, S. *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 575-580 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

Radiative transitions between the ground state pure $q\bar{q}$ vectorpseudoscalar mesons are studied non-perturbatively using equal-time commutationrelations (ETCRs) and the dynamical concept of asymptotic $SU_F(N)$symmetry. A number of predictions are made including $\Gamma(D^{*0}\to D^0\gamma)$, $\Gamma(D^{*+}\to D^+\gamma)$, etc.. In addition, hadronic partialwidths of D^{*+} and D^{*0} are calculated. The importance of the$SU_F(N)$ singlet piece of the electromagnetic current whenconsidering radiative decays and the experimental value of$\Gamma(K^{*0}\to K^0\gamma)/\Gamma(K^{*+}\to K^+\gamma)$ is pointed out.

32602 Relativistic multipole operators for semileptonic weak and electromagnetic nuclear reactions. Bennhold, C. (Institut fur Kernphysik, Johannes Gutenberg-Universitat, 6500 Mainz, Federal Republic of Germany(DE)); Wright, L. E.; Jin, Y. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2138-2144 (Jun 1989).

We discuss multipole operators that arise in a relativistic analysis ofsemileptonic weak and electromagnetic interactions with nuclei. Thesesingle-particle operators are evaluated between relativistic nucleon boundstates that are solutions to the Dirac equation with potentials of the formproduced by the σ-ω model. The reduced matrix elements aregiven in terms of easily programmable radial integrals and can be applied to anumber of reactions such as elastic and inelastic electron scattering, realphoton processes, β decay, and charged lepton capture as well as moreexotic interactions such as charged and neutral current neutrino reactions. Asa specific example, we calculate the elastic and inelastic magnetic formfactors of *p*-shell nuclei.

32603 Problems of describing spin-(3/2 baryon resonances in the effective Lagrangian theory. Benmerrouche, M. (Department of Physics, Rensselaer Polytechnic Institute, Troy, New York 12180-3590(US)); Davidson, R. M.; Mukhopadhyay, N. C. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2339-2348 (Jun 1989).

We investigate some important theoretical issues associated with the treatment of the spin-3/2 baryons in the effective Lagrangian theory. These are the form of the spin-3/2 particle propagator, off-shell parameters involving the spin-3/2 field; strategies of implementing gauge invariance, and unitarity. We comment on previous works by Peccei, Nath *et al.*, Williams, and Adelseck *et al.*, the last three works being in the context of recent revival of interest of baryon resonance structure in quantum chromodynamics. Our experience on the $\Delta(1232)$ resonance is invoked as a concrete example of dealing with these problems. Examples of some related problems in theories of massive vector and spin-3/2 particles, in pion decay and supersymmetry, respectively, are also discussed. These discussions should trigger new theoretical and experimental investigations in the study of baryon resonances excited from free hadrons and in complex nuclei.

32604 Correlation length and order of the deconfining phase transition. Berg, B. A. (Department of Physics and Supercomputer Computations Research Institute, The Florida State University, Tallahassee, Florida 32306(US)); Villanova, R.; Vohwinkel, C. *Physical Review Letters (USA),* 62(21): 2433-2435 (22 May 1989).

We analyze SU(2) and SU(3) lattice gauge theory on $L_t \times L^2 \infty$ lattices ($L_t \leq L$). By β_c we denote the critical coupling at $L=\infty$. In theneighborhood of the deconfining phase transition, at appropriately definedcoupling constants $\beta(L,L\prime)$, $L>L\prime$ [with $\beta(L,L\prime) \rightarrow \beta_c$ for $L\prime \rightarrow \infty$], the correlationlength ξ scales $\sim L/L\prime$ for second- and first-ordertransitions ($\xi = 1/E_1$ with E_1 the energy ofone unit of 't Hooft electric flux). Linearization around the couplings$\beta(L,L\prime)$ allows the calculation of critical exponents.Numerical results ($L_t=4$) support a second-order transition forSU(2), but not for SU(3).

32605 Constraints on muonium-antimuonium conversion. Chang, D. (Department of Physics and Astronomy, Northwestern University, Evanston, Illinois 60208(US)); Keung, W. *Physical Review Letters (USA),* 62(22): 2583-2585 (29 May 1989).

We discuss a simple model in which muonium-antimuonium conversion can occur at a level around the recent experimental bound but the process $\mu \rightarrow e\gamma$ is strictly forbidden. Measurements of the anomalous muon magnetic moment and high-energy Bhabha scattering $e^+e^- \rightarrow e^+e^-$ together provide an indirect and interesting constraint on the conversion. The model predicts anomalous events $ep \rightarrow e^-\mu\mu X$ at high-energy *ep* colliders.

32606 Anomalous ϕ production in $N\bar{N}$ annihilation: Four-quark exotics or $ss\bar{}$ components in the nucleon?. Dover, C. B. (Brookhaven National Laboratory, Upton, New York 11973(US)); Fishbane, P. M. *Physical Review Letters (USA),* 62(25): 2917-2920 (19 Jun 1989). DOE Contract AC02-76CH00016;FG05-84ER40157.

We argue that four-quark ($Q^2\bar{Q}^2$) intermediate-stateresonances containing a sizable $ss\bar{}$ admixture produce selectiveenhancements in particular $N\bar{N}$ annihilation channels with ϕmesons. The pattern of enhanced ϕ production induced by $N\bar{N}$coupling to $Q^2\bar{Q}^2$ resonances is compared to that due to$ss\bar{}$ admixtures in the N and $N\bar{}$.

32607 Comment on a paper by Rindani and Sivakumar. Hagen, C. R. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627(US)); Sudarshan, E. C. G. *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3176-3176 (15 May 1989).

In a recent work Rindani and Sivakumar claim to have found a newspin-3/2 theory with novel properties. It is shown here that thesystem which they consider is equivalent to the conventional Rarita-Schwingerequation. Their approach therefore appears unlikely to succeed in eliminatingany of the long-standing problems associated with the interactingspin-3/2 field.

32608 The reaction $\gamma\gamma \rightarrow \pi\pi$ at low energy. Goble, R. L. (Department of Physics, Clark University, Worcester, Massachusetts 01610(US)); Rosenfeld, R.; Rosner, J. L. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3264-3270 (1 Jun 1989).

The results of a previous calculation by two of the present authors are presented in a form more suitable for comparison with recent experiments on $\gamma\gamma \rightarrow \pi^+\pi^-$ and $\gamma\gamma \rightarrow \pi^0\pi^0$. The relation of the process $K_S \rightarrow \gamma\gamma$ to these calculations is recalled briefly.

32609 *CP*-violating decay $K_L{}^0 \rightarrow \pi^0\nu\bar{\nu}$. Littenberg, L. S. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3322-3324 (1 Jun 1989). DOE Contract AC02-76CH00016.

The process $K_L{}^0 \rightarrow \pi^0\nu\bar{\nu}$ offers perhaps the clearest window yet proposed into the origin of *CP* violation. The largest expected contribution to this decay is a direct *CP*-violating term at $\approx$few$\times 10^{-12}$. The indirect *CP*-violating contribution is some 3 *orders of magnitude* smaller, and *CP*-conserving contributions are also estimated to be extremely small. Although this decay has never been directly probed, a branching ratio upper limit of $\sim$1% can be extracted from previous data on $K_L{}^0 \rightarrow 2\pi^0$. This leaves an enormous range in which to search for new physics. If the Kobayashi-Maskawa (KM) model prediction can be reached, a theoretically clean determination of the KM product $\sin\theta_2 \sin\theta_3 \sin\delta$ can be made.

32610 QCD effects in the B^0-$B^-{}^0$ system. Kaufman, W. A. (Physics Department, University of Colorado, Boulder, Colorado 80309(US)); Yao, Y. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3373-3377 (1 Jun 1989).

We consider QCD effects on the B^0-$B^-{}^0$ system for $m_t{}^* \approx m_W$ and $m_t{}^* \gg m_W$, where $m_t{}^*$ and m_W are top-quark and *W*-boson masses. The role of the external-quark kinematics in producing "hybrid" logarithms generated in the momentum range $\mu^2 < p^2 < m_Q{}^2$ is also examined, where μ is the binding energy of the *B* meson and m_Q is the mass of the heavy external quark.

32611 Neutrino electromagnetic form factors. Vogel, P. (Physics Department, California Institute of Technology, Pasadena, California 91125(US)); Engel, J. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3378-3383 (1 Jun 1989).

It has been suggested that an apparent correlation of the flux of detected solar neutrinos with solar activity is due to a neutrino magnetic moment. Here several terrestrial experiments that might observe the magnetic moment are considered, with emphasis on those employing reactor neutrinos. The neutrino charge radius, and prospects for observing it, are also discussed. An appendix collects all relevant neutrino scattering cross sections.

32612 Hyperon resonances in the chiral bag model. Umino, Y. (Department of Physics, State University of New York at Stony Brook, Stony Brook, New York 11794(US)); Myhrer, F. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3391-3401 (1 Jun 1989).

We calculate the masses of low-lying negative-parity Λ^* and Σ^* in a chiral bag model with broken SU(2)$\otimes$SU(2) realization of chiral symmetry. All relevant one-gluon-exchange and effective quark-quark one-pion-exchange diagrams are evaluated. We show why the spin-flavor contents of the hyperon resonances are different from that of a nonrelativistic quark model. In particular, we find that

the Λ(1405) has almost no flavor-singlet component. The prescription used to project out the translational mode of the bag is tested for the simplest case.

32613 New parametrization of the Kobayashi-Maskawa matrix and its implications. Campa, A. (Department of Physics, The Rockefeller University, 1230 York Avenue, New York 10021(US)); Hamzaoui, C.; Rahal, V. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3435-3442 (1 Jun 1989).

We propose a new parametrization of the quark mixing matrix (the Kobayashi-Maskawa matrix) in terms of four independent moduli of its matrix elements: $|V_{us}|$, $|V_{cb}|$, $|V_{td}|$, and $|V_{ub}|/|V_{cb}|$. Based on this convenient parametrization, we study the constraints on the top-quark mass and the quark mixing elements $|V_{ij}|$ from the recent measurement of ϵ'/ϵ, the ARGUS result on $B_d{}^0$-$\bar{B}\,d^0$ mixing, the ratio $|V_{ub}|/|V_{cb}|$, and the mixing parameter ϵ in the K^0-K^{-0} system taking into account all the uncertainties in the input.

32614 *CP* violation in the two-generation version of left-right models. Liu, J. (Physics Department, University of Michigan, Ann Arbor, Michigan 48109(US)); Geng, C. Q.; Ng, J. N. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3473-3477 (1 Jun 1989).

Recent measurements of $\epsilon'/\epsilon \sim 3\times10^{-3}$ and D_n, the neutron electric dipole moment, of the order 10^{-25} e cm if confirmed may be used to place useful constraints on different *CP*-violation models. In this paper, we study their implications on a class of two-generation versions of minimal left-right models. We find that, if all these observations are to be explained by these models, the *CP*-violation phases of the model must fall into an interesting fine-tuned hierarchical pattern. A realization of such a pattern is illustrated in a minimal spontaneous *CP*-violation model.

32615 Coupled-channel effects in the decay $\Upsilon(3S)\to\Upsilon(1S)\pi^+\pi^-$. Moxhay, P. (Department of Physics, University of Colorado, Campus Box 390, Boulder, Colorado 80309(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3497-3499 (1 Jun 1989).

The spectrum of the decay$\Upsilon(3S)\to\Upsilon(1S)\pi^+\pi^-$ is fitted assuming-interference between a multipole amplitude containing an Adler zero and aconstant nonmultipole amplitude. It is argued that the coupling to*b*-flavored channels may be large enough to account for the nonmultipoleeffect.

32616 Singlet dilambda in the chiral theory. Diakonov, D. I. (Leningrad Nuclear Physics Institute, Gatchina, Leningrad, 188350 Union of Soviet Socialist Republics(SU)); Petrov, V. Y.; Pobylitsa, P. V.; Prasza@/rl@xXowicz, M. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3509-3512 (1 Jun 1989).

The mass of a singlet strangeness −2 state is calculated from a low-momentaQCD Lagrangian involving dynamically massive quarks interacting withpseudoscalar fields. Minimizing the aggregate energy of the quark Dirac seaplus the energy of a bound-state level of six valence quarks, we findM_H=2.11 GeV in the chiral limit. The mass shift due tothe strange-quark mass is estimated to be of the order of 300 MeV. This stateis classically parity degenerate. Its splitting and width are due tononperturbative tunneling and therefore are suppressed ase^{-N_c}.

6453 Particle Invariance Principles and Symmetries

Refer also to citation(s) 32609, 32616, 32638

32617 (ITP–87-140) **Chiral symmetry breaking and nonperturbative scale anomaly in gauge field theories.** Miranskij, V.A.; Gusynin, V.P. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1987. 41p. Order Number DE89615405/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The nonperturbative dynamics of chiral and scale symmetry breaking in asymtotically free and non-asymptotically free (with an ultraviolet stable fixed point) vector-like gauge theories is investigated. In the two-loop approximation analytical expressions for the chiral and gluon condensates are obtained. The hypothesis about a soft behaviour at small distances of composite operators in non-asymptotically free gauge theories with a fixed point is put forward and substantiated. It is shown that in these theories the form of the scale anomaly depends on the type of the phase in coupling constant to which it relates. A new dilaton effective lagrangian for glueball and chiral fields is suggested. The mass relation for the single scalar fermion-antifermion bound state is obtained. The important ingredient of this approach is a large (d≃ 2) dynamical dimension of composite chiral fields. The application of this approach to QCD and technicolour models is discussed. 39 refs.; 1 fig.

32618 (LBL–25784) **Symmetry breaking: The standard model and superstrings.** Gaillard, M.K. Lawrence Berkeley Lab., CA (USA). 31 Aug 1988. 23p. Sponsored by DOE/ER;OGA. DOE Contract AC03-76SF00098. PHY85-15857. (CONF-8807166–1: Topical conference on particle physics and cosmology, Trieste, Italy, 25-28 Jul 1988;UCB-PTH–88/20). Order Number DE89011771/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The outstanding unresolved issue of the highly successful standard model is the origin of electroweak symmetry breaking and of the mechanism that determines its scale, namely the vacuum expectation value (vev)v that is fixed by experiment at the value v = $4m_w{}^2$ /gsup 2 = (radical2Gsub F)sup minus1 approx_equal 1/4 TeV. In this talk I will discuss aspects of two approaches to this problem. One approach is straightforward and down to earth: the search for experimental signatures, as discussed previously by Pierre Darriulat. This approach covers the energy scales accessible to future and present laboratory experiments: roughly (10sup minus9 minus 10sup 3)GeV. The second approach involves theoretical speculations, such as technicolor and supersymmetry, that attempt to explain the TeV scale. 23 refs., 5 figs.

32619 (NBI-HE–89-06) **Schwinger-Dyson equations as supersymmetric Ward identities.** Alfaro, J.; Damgaard, P.H. Niels Bohr Inst., Copenhagen (Denmark). Jan 1989. 7p. Order Number DE89775042/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

We point out that the Schwinger-Dyson equations of any quantum field theory can be understood as supersymmetric Ward identities of a supersymmetric extension of the theory.

32620 Parity doubling in baryons and its relevance to hadronic structure. Iachello, F. (Center for Theoretical Physics and A. W. Wright Nuclear Structure Laboratory, Yale University, New Haven, Connecticut 06511(US)). *Physical Review Letters (USA),* 62(21): 2440-2443 (22 May 1989).

The occurrence of parity doubling in baryon spectra is pointed out and itsrelevance to hadronic structure is discussed. It is suggested that paritydoubling is a consequence of the geometric structure of baryons.

32621 Wormhole solution to the strong *CP* problem. Choi, K. (Department of Physics, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213(US)); Holman, R. *Physical Review Letters (USA),* 62(22): 2575-2578 (29 May 1989).

We show that the procedure of maximizing $G^{-1}(\alpha)$, the inverse of Newton's constant within the wormhole calculus, subject to the constraint that the effective cosmological constant vanish, drives the QCD θ parameter to θ=0,π which are the *CP* conserving values. We argue that, in fact, $\theta=\pi$ is the preferred value and discuss the phenomenological consistency of this choice.

32622 Nambu–Jona-Lasinio model and charge independence. Henley, E. M. (Institute for Nuclear Theory, Department of Physics, FM-15, University of Washington, Seattle, Washington 98195(US)); Krein, G. *Physical Review Letters (USA),* 62(22): 2586-2588 (29 May 1989).

For different up and down current quark masses, charge independence follows in the Nambu–Jona-Lasinio model from chiral-symmetry breaking; however, chiral symmetry is restored at high densities. The dependence of the constituent quark masses and the neutron-proton mass difference on the density are examined. The effect of the up-down-quark mass difference on the neutron-proton mass difference is large and in the right direction to explain the Nolen-Schiffer anomaly.

32623 Why is the Υ(3*S*) different?. Lipkin, H. J. (Department of Nuclear Physics, Weizmann Institute of Science, Rehovot 76100, Israel(IL)); Tuan, S. F. *Physical Review Letters (USA),* 62(25): 2910-2912 (19 Jun 1989).

The $\Upsilon(3S)$ is much closer than lower $\Upsilon(nS)$ states to$B\bar{B}$ and $B^*\bar{B}$ thresholds. These "*s*-channelsingularities" may dominate $\Upsilon(3S)$ decay amplitudes, while"*t*-channel gluonic states" dominant in conventional models are moreimportant for other decays. An "*s*-channel" decay mechanism ofsequential pion emission via a heavy intermediate state such as $B\bar{B}$ or$B^*\bar{B}$ predicts a qualitatively different pion spectrum from thatpredicted by conventional "*t*-channel" models for$\Upsilon(3S)\rightarrow\Upsilon(nS)\pi\pi$ decays and the yet unobserved$\Upsilon(3S)\rightarrow\Upsilon(^1P_1)\pi\pi$ decay and may explainthe observed disagreement between experiment and previous predictions as wellas the difference between the $\Upsilon(3S)$ and other states.

32624 Symmetry in string theory. Evans, M. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19104-6396(US)); Ovrut, B. A. *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3016-3022 (15 May 1989).

A general method for determining the target-space symmetries, both broken and unbroken, of string theory is presented. Symmetries are shown to be consequences of a class of automorphisms of the world-sheet operator algebra. This formalism is used to prove general coordinate invariance, two-form gauge invariance, and non-Abelian gauge invariance in heterotic string theory.

32625 Parity-violating one-loop function in lower-dimensional type-I string theory. Lin, Z. (Department of Physics and Astronomy, University of Alabama, Tuscaloosa, Alabama 35487(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3023-3033 (15 May 1989).

The parity-violating one-loop functions with three and four external gauge bosons accompanied by five external massless scalars in lower-dimensional type-I string theory are evaluated in closed form. The finiteness and anomaly freedom of the amplitudes are also proved independent of the internal symmetry.

32626 Angular correlations in the decay $B\rightarrow VV$ and *CP* violation. Valencia, G. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3339-3345 (1 Jun 1989). DOE Contract AC02-76CH00016.

We study the exclusive decays of *B* mesons into a pair of spin-1 mesons. We look at the occurring asymmetries that could signal *CP* violation and estimate their relative size. We find that angular asymmetries are not significantly smaller than partial-rate asymmetries, and that their study can help disentangle the complicated dynamics of these decays.

32627 SU(3) predictions for nonleptonic *B*-meson decays. Savage, M. J. (California Institute of Technology, Pasadena, California 91125(US)); Wise, M. B. *Physical Review [Section] D: Particles and Fields (USA),* 39(11): 3346-3356 (1 Jun 1989).

The smallness of the up-, down-, and strange-quark masses compared with the QCD scale makes SU(3) flavor an approximate symmetry of the strong interactions. The B^-, B^0, and B_s^0 mesons form a $\bar{3}$ representation of SU(3). Using the SU(3) transformation properties of the effective Hamiltonian for weak nonleptonic *B*-meson decays, relations are derived between *B*-meson decay amplitudes. Some of these relations may provide information on the importance of various competing effects that can occur in nonleptonic *B*-meson decays.

6454 Field Theory

Refer also to citation(s) 32607, 32610, 32624, 32625

32628 (IFT-TD–11/87) **Dynamical breakdown of chiral symmetry in vectorial theories: QED and QCD.** Garcia, J.C.M. Instituto de Fisica Teorica, Sao Paulo, SP (Brazil). 1987. 141p. (In Portuguese). Order Number DE89612009/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Using a variational approach for the Effective Potential for composite operators we dicuss the dynamical breakdown of chiral symmetry in two vectorial theories: Quantum Electrodynamics (QED) and Quantum Chromodynamics (QCD). We study the energetic aspects of the problem calculating the Effective Potential with the asymptotic nonperturbative solutions of the Schwinger-Dyson equation for the fermion selfenergy.

32629 (INFN-AE–88-12) **Structure constants of the (A,D) minimal C less than 1 conformal models.** Petkova, V.B. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1989. 12p. Order Number DE89612010/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The primary field structure constants of the (A,D) minimal c<1 series are computed explicitly. Various inperpretations of the fusion algebras are discussed.

32630 (ITF–87-166) **Electron in an external magnetic field: boundary conditions, anomaly and index.** Sitenko, Yu.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 19p. (In Russian). Order Number DE89615386/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The index theorem is applied to the problem of electron in external magnetic field in a bounded domain of finite size. The boundary condition which is equivalent to the square integrability condition for zero modes in unbounded infinite domain is found. 20 refs.

32631 (ITP–87-154) **Deconfinement analysis in exactly solvable model of lattice QCD in strong coupling approximation.** Borisenko, O.A.; Petrov, V.K.; Zinov'ev, G.M. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1987. 13p. Order Number DE89615387/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

An exactly solvable model of lattice QCD in strong coupling approximation is constructed using the spherical model of ferromagnet. An analytical solution obtained in the paper is consistent with Monte-Carlo numerical experiments. 12 refs.; 2 figs.

32632 (KIFVE–88-07) **Gauge invariant gravitation theory. 1. Gravitational field source and spin.** Pantyushin, A.A. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 42p. (In Russian). Order Number DE89615388/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

It is shown that gauge invariance occurs as the consequence of physical field (fields with certain spin) description by the values, transformed as irreducible representations of homogeneous Lorentz group. Gauge-invariant lagrangian of the field of 2 spin was constructed. It was proved that gravitational field represented the superposition of gauge-invariant fields of 2 and 0 spins. Occurrence of the zero spin field is directly related with nonpreservation of the (gauge-invariant) source of gravitational field. 19 refs.

32633 (KIYI–88-35) **On canonical quantization of the electromagnetic field in terms of field strengths.** Krivskij, I.Yu.; Simulik, V.M. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 19p. (In Russian). Order Number DE89615389/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The program of canonical quantization of the electromagnetic field strengths B=(E-vector, H-vector) is performed. We have found the simplest Lagrangian function in terms of field strengths which has allowed the interpretation of the electric field strength E-vector as the field coordinate and the magnetic field strength H-vector - as the field momentum. The 000-component of the Lipkin Zilch tensor plays the role of the Hamiltonian density in this scheme. We have connected the canonical amplitudes of the scheme with the creation and annihilation operators of the real (transverse) photons. This allowed us to find the commutation relations for the quantized field strengths tensor <Bx> in the manifestly covariant form. 30 refs.

32634 (LAL–88-21) **Study of the e/sup +/e/sup -/annihilation reaction into four leptons.** Le Diberder, F. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 - Orsay (France). Jun 1988. 317p. (In French). Order Number DE89776437/JAW. Available from NTIS (US Sales Only), PC A14/MF A01.

The experimental study presented in this thesis has been carried out within the CELLO collaboration. The detector was located at the electron positron storage ring PETRA. The aim of this analysis is to provide an accurate test of Quantum Electrodynamics to fourth order in perturbation theory, making use of the electron-positron annihilation into four leptons. The thesis is subdivided into three chapters. In the first chapter, a theorical description of the processes is given. It is shown that the standard description of the

single tag reaction in terms of photon-photon collision is not satisfactory. A more precise expression of the differential cross-section is given. The expression involves on the one hand three structure functions and on the other hand a correction term accounting for the non-multiperipheral diagrams, in particular. The second chapter is devoted to a preliminary analysis of the performances of the detector and to a determination of the integrated luminosity accumulated by the experiment. In the third chapter the results of the four-lepton final state anaysis are presented. This analysis is divided into two main parts. In the first part single tag events are considered. The contributions of the three above-mentioned structure functions and, in particular, the azimuthal dependence of the cross-section are measured at the percent level. The role of the non-multiperipheral diagrams is demonstrated. In the second part the analysis of events where all four particles are detected at large angle is presented. The excellent agreement observed between data and theory, in all the kinematical configurations which have been considered, provides a new and accurate test of Quantum Electrodynamics.

32635 (NBI-HE–89-07) **SU(2) lattice gauge theory with an external field.** Ambjoern, J.; Mitrjushkin, V.K.; Bornyakov, V.G.; Zadorozhny, A.M. Niels Bohr Inst., Copenhagen (Denmark); Joint Inst. for Nuclear Research, Dubna (USSR). Feb 1989. 11p. Order Number DE89775045/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The properties of pure gauge SU(2) lattice theory in the presence of background constant chromomagnetic field H are studied. We calculate the contributions of electric and magnetic modes to the internal energy both in the confinement and deconfinement phases. The dependence of the magnetic part of the energy on H is positive and consistent with the H/sup 2/behaviour up to possible logarithmic corrections. At the same time the dependence of the electric component differs drastically from the magnetic one.

32636 The world according to lattice QCD. Sharpe, S. R. (University of Washington, Seattle, WA 98195(US)). *AIP (American Institute of Physics) Conference Proceedings (USA),* 185(1): 55-67 (25 Apr 1989). (CONF-880862–: BNL workshop on glueballs, hybrids and exotic hadrons, Upton, New York, USA, 29 Aug - 1 sep 1988).

A non-technical introduction to lattice calculations is given. The successes and problems of current calculations are emphasized. A summary of lattice results on non-exotic meson and baryon masses indicates that while calculations in the quenched approximation are becoming reliable, the results differ in systematic ways from the physical values. Results for exotic mesons (glueballs and hybrids) are then presented. The future prospects are discussed.

32637 Dynamics of non-integrable phases and gauge symmetry breaking. Hosotani, Y. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455(US)). *Annals of Physics (New York) (USA),* 190(2): 233-253 (Mar 1989).

On a multiply-connected space the non-integrable phase factor$P\exp(ig\int A_\mu dx^\mu\})$, a path-ordered line integral along anoncontractable loop, becomes a dynamical degree of freedom in gauge theory.The dynamics of such non-integrable phases are examined in detail with themost general boundary condition for gauge fields and fermions. Sometimesthe dynamics of the non-integrable phases compensate the arbitrariness inthe boundary condition imposed, leading to the same physics results. Inother cases the dynamics of the non-integrable phases induce spontaneousbreaking of non-Abelian gauge symmetry. In other words the physically realizedsymmetry of the system differs from, and can be either greater or smaller than,the symmetry of the boundary condition. The effective potential for thenon-integrable phases in the $SU(N)$ gauge theory on$S^1\otimes R^{1d-2}$is computed in the one-loop approximation. It is shown that the gauge symmetryis dynamically broken in the presence of fermions in the adjoint representation,depending on the value of the boundary condition parameter.© 1989 Academic Press, Inc.

32638 Variational calculations and Bogolubov transformations. Wudka, J. (Physics Department, University of California at Davis, Davis, California 95616(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3000-3006 (15 May 1989).

The usefulness of the Bogolubov transformations in variational calculations is demonstrated using the massive Thirring model as a specific example. It is shown that such transformations can be chosen so that the expectation value of the Hamiltonian is regulator independent when the exact form of the counterterms is used. Moreover enough freedom is left to optimize the variational state as a trial vacuum. The problem of dealing with the anomalous commutators that arise in the model is discussed.

32639 Renormalization of the δ expansion of $\lambda(\phi^{2+2\delta})_2$ theory. Cline, J. (Department of Physics, The Ohio State University, Columbus, Ohio 43210(US)); Pinsky, S.; Simmons, L. M., Jr. *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3043-3050 (15 May 1989).

We study a new artificial expansion method, the δ expansion, which interpolates between a soluble interaction $\lambda\phi^2$ and the interaction of interest $\lambda\phi^4$ using the form $\lambda(\phi^{2+2\delta})$. The δ expansion is applied to a scalar field theory with an interaction $\lambda(\phi^{2+2\delta})$ in two dimensions. The two-point, four-point, and six-point one-particle-irreducible Green's functions are calculated through third order in δ. The theory is renormalized and it is found that in a class of prescriptions the δ expansion of $\lambda(\phi^{2+2\delta})_2$ reproduces the standard weak-coupling expansion of $\lambda(\phi^4)_2$ for all $\delta>0$. All other renormalization prescriptions make the theory equivalent to $\lambda(\phi^{2P})_2$ for an arbitrary positive integer P.

32640 Higgs coupling and the decoupling theorem. Brown, L. S. (Department of Physics FM-15, University of Washington, Seattle, Washington 98195(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3084-3087 (15 May 1989).

The Higgs field couples to the fermion mass insertions. The remnant of this coupling when some fermions become very heavy and decouple is derived by renormalization-group techniques. Our work confirms the result of Shifman, Vainshtein, and Zakharov and provides the first-order correction.

32641 Interpreting four-quark interactions in finite-temperature, SU(2), lattice gauge theory. Kiskis, J. (Department of Physics, University of California, Davis, California 95616(US)); Narayanan, R. *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3121-3126 (15 May 1989).

Associated with the finite-temperature lattice gauge theory is an effective theory of Wilson lines. The strength of the four-line interaction has been measured by Monte Carlo simulation in earlier work. This paper adds perspective to the numerical work in two ways. First, the physical interpretation of the four-line coupling is given. Second, the relationship with critical behavior in three-dimensional scalar theories is established. On this basis, a complete postdiction of the numerical results can be given.

32642 Preconditioning the Kogut-Susskind fermion matrix. McCarthy, J. F. (Department of Physics, Indiana University, Bloomington, Indiana 47405(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3167-3170 (15 May 1989).

Preconditioning has been successfully used to accelerate theconjugate-gradient algorithm for inverting the lattice Dirac operator in theWilson formulation. However, technical problems have arisen when trying toapply it in the Kogut-Susskind formulation. We discuss attempts to circumventthe technical problems and to find a successful way to precondition theKogut-Susskind fermion matrix.

32643 Gauge-invariant correlation functions. Kapusta, J. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455(US)); Toimela, T. *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3197-3199 (15 May 1989).

A formalism is discussed that gives correlation functions, the poles ofwhich define the physical excitation spectrum in gauge theories. Fermionicexcitations in QED are used as an example. The fermion spectrum in ahigh-temperature plasma is studied as an illustrative application of theformalism. The connection to kinetic theory is made.

32644 Effects of initial-state QCD interactions in the Drell-Yan process. Bodwin, G. T. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439(US)); Brodsky, S. J.; Lepage, G. P. *Physical Review [Section] D: Particles and*

Fields (USA), 39(11): 3287-3296 (1 Jun 1989). DOE Contract W-31-109-ENG-38.

We develop a simple, intuitive picture of the effects, in the Drell-Yan process, of initial-state interactions between the projectile and the target. For purposes of illustration, we present specific analyses in terms of a nonrelativistic QED model. However, our principal conclusions are valid in QCD as well. We show that initial-state interactions lead to an increase in the average of the square of the transverse momentum of the lepton pair that is proportional to the length of the target, and we also demonstrate that initial-state interactions can invalidate the parton-model (factorized) form of the cross section unless the beam energy is greater than a scale that grows with the length of the target.

65 PHYSICS II

Refer also to citation(s) 30986, 30990, 33025

6510 Nuclear Physics

Refer also to citation(s) 32722, 32990

32645 (CTA-EAv-IS–001/80) **Activities planning of Nuclear Data Center - 1980.** Nair, R.P.K. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais. 11 Mar 1980. 9p. (In Portuguese). Order Number DE89614722/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The main process systems of nuclear data files and the actual nuclear data processing implantation in the Instituto de Estudos Avancados, are presented. The research activities of Nuclear Data Center during 1980 in relation to the implantation of file process systems for multigroup cross sections, and the calculations of integral reactor parameters, are described. (M.C.K.).

32646 (INDC(CCP)–290/LJ) **Spectra of inelastically scattered neutrons with an initial energy of 14.1 MeV and nuclear level density.** Sal'nikov, O.A.; Fetisov, N.I.; Lovchikova, G.N.; Kotel'nikova, G.V.; Anufrienko, V.B.; Devkin, B.V. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Feb 1989. 17p. Order Number DE89615818/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Translated by the IAEA.

The results of measurements of the spectra of secondary neutrons emitted in the interaction of 14.1 MeV neutrons with the nuclei of the following elements: Be, Na, Mg, S, K, Ca, Sr, In, Sb, I, Cs, Ce, Ta, Hg are presented. The availability of such systematic data permitted a better understanding of the dependence of nuclear temperature and nuclear level density parameter on the mass number, of the mechanism of (n,n') reaction and of the neutron spectra from (n,2n) reactions. 17 refs, 10 figs, 3 tabs.

32647 (INIS-SU–78) **Neutron physics. Vol. 2.** Kuz'minov, B.D. (ed.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 357p. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Individual papers in this conference proceedings are indexed separately.

32648 (KFK–4508) **Annual report on nuclear physics activities. July 1, 1987 - June 30, 1988.** Doll, P.; Meisel, G. (eds.). Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik. Feb 1989. 175p. Order Number DE89774742/JAW. Available from NTIS (US Sales Only), PC A08/MF A01.

This report surveys the activities in basic research from July 1, 1987 to June 30, 1988 at the Institute for Nuclear Physics (IK) of the Kernforschungszentrum Karlsruhe. The research program of this institute comprises nuclear astropysics, laser spectroscopy, nuclear reactions with light ions, neutron physics, neutrino physics and high energy physics, as well as detector technology.

32649 (LAFI–127) **Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes.** Lapenas, A.A.; Ryabykh, Yu.I.; Sen'kov, P.E. AN Latvijskoj SSR, Riga (USSR). Inst. Fiziki. 1988. 45p. (In Russian). Order Number DE89615819/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The radiation capture cross sections for /sup 115/In(n,γ)/sup 116/In/sup m/, /sup 197/Au(n,γ)/sup 198/Au, /sup 127/I(n,γ)/sup 128/I, /sup 139/La(n,γ)/sup 140/La, /sup 59/Co(n,γ)/sup 60/Co, /sup 55/Mn(n,γ)/sup 56/Mn and /sup 63/Cu(n,γ)/sup 64/Cu reactions in a 620 group structure in the energy range of 10/sup -10/up to 18 MeV are presented. The cross sections have been calculated into terms of the Breit-Wigner multilevel formula in the resolved resonance region. Th data of other libraries or results of experimental data evaluation were used. Average cross sections in the "benchmark" neutron fields and resonance detector characteristics are presented as well. 9 refs.; 4 tabs.

6511 Experimental Techniques

32650 (DPHN–89-1) **Activity report.** Anon. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire. Jan 1989. 219p. (In French). Order Number DE89776467/JAW. Available from NTIS (US Sales Only), PC A10/MF A01.

This report summarizes all work during the period October 1987 to September 1988 done at the Nuclear Physics Department in our main areas of interest, namely Heavy Ion Physics and Intermediate Energy Physics. Heavy ion physics is done along three main lines: study of collisions between complex nuclei and hot nuclei using GANIL and SATURNE, exotic nuclei and giant resonance studies using GANIL and SPEG. In the intermediate energy domain, our main effort is made on the study of few-nucleon systems, using the hadronic or electromagnetic probes.

6512 Nuclear Properties and Reactions, A=1-5, Experimental

Refer also to citation(s) 32656

32651 (FRCEA-TH–84) **Study of the electromagnetic response functions and momentum distributions of large linear momentum protons in the helium-3 nucleus using inelastic electron scattering.** Marchand, C. Paris-11 Univ., 91 - Orsay (France). Sep 1987. 280p. (In French). Order Number DE89776432/JAW. Available from NTIS (US Sales Only), PC A13/MF A01.

The He3 nuclear structure was studied, particularly the longitudinal and transverse response functions and the momentum distribution of high linear momentum protons. Measurements of the inclusive cross sections for incident energies between 120 and 667 MeV were used to derive the electromagnetic response functions for momentum and energy transfers covering the quasi-elastic region and a part of the delta resonance (1232). The Coulomb sum rule is saturated for momentum transfers $\geq$ 500 MeV/sec. The drop to zero of the longitudinal response after the quasi-elastic peak confirms the transverse nature of the mesic exchange currents and of the excitation of the delta resonance in the nucleus. Measurement of the (e, e'p) exclusive cross sections at 560 MeV incident energy allowed a direct determination of proton linear momentum distributions at 300 to 600 MeV/c for the pd and ppn decay channels. The data agree with wave function calculations and do not indicate an excess of high momentum components. Analysis of the ppn decay channel indicates that high linear momentum components in He3 are dominated by two-nucleon processes, i.e., nucleon-nucleon correlations at medium and short range. Kinematic evidence supports this picture: displacement of the missing energy and dynamic spectra, and comparison of the linear momentum distribution for protons in He3 and deuterium.

32652 (INIS-mf–11415) **Two-body electrodisintegration of /sup 4/He studied through the (e,e'X) reaction.** Brand, F.J.F. van den. Amsterdam Univ. (Netherlands). 1 Dec 1988. 194p. Order Number DE89610045/JAW. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Includes summaries in Dutch and Limburgian.

A study of the electrodisintegration of 4/He into a proton and a triton is discussed. The purpose of this investigation is to obtain the proton spectral function which in turn is expected to contain information on the short-range and tensor correlations in the four-nucleon system. The /sup 4/He(e,e'p)/sup 3/H experiment was performed with the electron-scattering facility at NIKHEF-K. A specially designed cryogenic target system was used. From the data precise absolute cross sections were extracted with good missing-energy resolution as a funtion of missing momentum in the range 10<—p/sub m/— <350 MeV/c. The data were taken in two kinetamical configurations, corresponding to different combinations of the transferred four-impuls Q/sup 2/and the polarization parameter of the exchanged virtual photon. In PIWA the (e,e'p) cross section factorizes into an off-shell electron-proton cross section and the spectral funtion. In the region where both kinetamics overlap a strong dependence of the extracted spectral-function results on the kinematic variables was observed whereas such a dependence should not occur in PWIA. In order to understand this apparent breakdown of the PWIA the influence of rescattering of the outgoing proton on the residual nucleus or final-state interactions and the electron-proton coupling on the spectral function have been investigated. The spectral-function data for the full missing-moment range have been compared to various theoretical results. It turns out that the data are best described in the microscopic framework starting from a correlated wave function. The results are presented obtained with the /sup 4/He(e,e'/sup 3/H)p reaction from which information can be obtained about the proton spectral function at momentum values up to 550 MeV/c. At these high proton moments a more direct signature of pair-correlations in the /sup 4/He system can be obtained.

32653 (INIS-SU–78, pp. 298-302) **Investigation of intermediate neutron interaction with tritium and hydrogen.** Kirilyuk, A.L. (AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij); Grebnev, A.V.; Vorona, P.N.; Gnidak, N.L. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 14-18 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The results of the total neutron cross sections of tritium and hydrogen for 2 keV and 145 keV neutrons using filtered beam technique are presented. 10 refs.; 2 tabs.

6513 Nuclear Properties and Reactions, A=6-19, Experimental

Refer also to citation(s) 32565, 32670, 32695

32654 (CRN-PN–88-24) **Resonance in /sup 15/N and /sup 14/C induced reactions.** Haas, F. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1988. 9p. (CONF-8808116–: Sapporo international symposium: developments of nuclear cluster dynamics, Sapporo, Japan, 1-3 Aug 1988). Order Number DE89776488/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Strong resonances are observed in /sup 15/N and /sup 14/C induced reactions. Resonance phenomena are a general aspect of light heavy ion collisions at energies well above the barrier, they are strongest in reactions between the 'stable' nuclei /sup 12/C, /sup 14/C, /sup 15/N and /sup 16/F.

32655 (CRN-PN–8630) **C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels.** Haas, F. 5Strasbǫug-1 Univ., 67; Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. 1986. 9p. (CONF-8611214–: 16. international symposium on nuclear physics - dynamics of heavy ion collisions, Gaussig, German Democratic Republic, 10-14 Nov 1986). Order Number DE89776430/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Resonance phenomena for C + O systems having one or two neutrons outside the C12 or 016 cores were investigated. Results of experiments with the gamma ray method and with the kinematical coincidence method were combined. Reactions studied were 017 + C12, 016 + C13, 017 + C13, 018 + C12, and 016 + C14. The 017 + C12 and 016 + C13 reactions are compared. Resonances in the composite system Si30 formed by 018 + C12 and 016 + C14 are discussed. For the C + 0 systems studied, different types of resonances are established, but detailed experimental measurements are required to better understand them.

32656 (KIYI–88-10) **Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances.** Vasil'ev, Yu.O.; Karmanov, F.I.; Komarov, V.V. and others. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 21p. (In Russian). Order Number DE89615823/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A dependence of characteristics of short-lived nuclear resonances on conditions of its excitation observed in correlation experiments is investigated. A sharp sensitivity of angular and energetic distributions of decay products to Coulomb field of accompanying prticle is shown. The theoretical expressions for shift and broadening of resonances and also the results of kinematically complete experiments are presented to be compared to the proposed theoretical approximations with account of influence of Coulomb field. 16 refs.; 13 figs.

32657 **$^{14}C(\pi^+,\pi^-)^{14}O$ reaction between 19 and 80 MeV.** Leitch, M. J. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Baer, H. W.; Burman, R. L.; Morris, C. L.; Knudson, J. N.; Comfort, J. R.; Wright, D. H.; Gilman, R.; Rokni, S. H.; Piasetzky, E.; and others. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2356-2366 (Jun 1989).

Cross-section measurements are reported for the $^{14}C(\pi^+,\pi^-)^{14}O$ reaction to the double isobaric analog state and for nonanalog states at 5 to 10 MeV excitation. The extrapolated zero-degree cross sections are 2.3±0.5, 3.7±0.4, 2.2±0.3, and 0.9±0.3 μb/sr at 19.0, 29.1, 64.4, and 79.5 MeV, respectively. The nonanalog-state cross sections are found to rise sharply with increasing beam energy above 50 MeV, in contrast to those of the double isobaric analog state transition. Calculations with a phenomenological isospin-dependent optical potential must include an isotensor term, which accounts for transitions through nonanalog intermediate states or other short-range correlations, in order to describe the energy and angular trends of the data. Microscopic calculations in the second-order distorted-wave impulse approximation fail to reproduce the cross sections near 50 MeV unless the effects of short-range correlations beyond those contained in the model are incorporated.

32658 **Measurement of $^{16}O(\gamma,n)^{15}O$ at medium energies.** Beise, E. J. (Bates Linear Accelerator Center, Laboratory for Nuclear Science Department of Physics, M.I.T., Cambridge, Massachusetts 02139(US)); Dodson, G.; Garcon, M.; Hoibraten, S.; Maher, C.; Pham, L. D.; Redwine, R. P.; Sapp, W.; Wilson, K. E.; Wood, *Physical Review Letters (USA),* 62(22): 2593-2596 (29 May 1989).

Exclusive differential cross sections for the $^{16}O(\gamma,n)^{15}O$ process have been measured for E_γ=150, 200, and 250 MeV and θ_L=49°, 59°, and 88°. This measurement is the first of its type to be reported for the energy region above the pion production threshold. An uncollimated bremsstrahlung beam was incident on an H_2O target, and neutrons were measured with a recoil proton spectrometer with resolution sufficient to identify the residual ^{15}O ground state. The results are compared to (γ,p) data and to calculations including effects from meson exchange currents.

32659 **Threshold behavior of electron pair production in *p*-Be collisions.** Naudet, C. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720(US)); Bystricky, J.; Carroll, J.; Gordon, J.; Hallman, T.; Igo, G.; Kirk, P.; Krebs, G. F.; Lallier, E.; Landaud, G.; and others. *Physical Review Letters (USA),* 62(23): 2652-2655 (5 Jun 1989). DOE Contract AC03-76SF00098;FG03-88ER40424;FG02-88ER40413;FG05-

We report on the measurements of electron pair production in *p*-Becollisions at 1.0, 2.1, and 4.9 GeV beam kinetic energies. The invariant-massand transverse-momentum spectra are presented, along with the total crosssections. A rapid decrease in the integrated cross section is observed as thebeam energy is reduced. Comparison of the excitation function for dielectron(e^+e^-) and dipion ($\pi^+\pi^-$)production suggests that the dominant production

mechanism at beam kineticenergies 2.1 and 4.9 GeV may be $\pi^+\pi^-$ annihilation.

32660 **Electrodisintegration of ^{6}Li studied with the reaction ^{6}Li($e,e'p$).** Lanen, J. B. J. M. (Fysisch Laboratorium, Rijksuniversiteit Utrecht, 3508 TA Utrecht, The Netherlands(NL)); van den Berg, A. M.; Blok, H. P.; van den Brand, J. F. J.; Christou, C. T.; Ent, R.; van Hees, A. G. M.; Jans, E.; Kramer, G. J.; Lapikas, L.; and o *Physical Review Letters (USA),* 62(25): 2925-2928 (19 Jun 1989).

The ^{6}Li→p+($n\alpha$) spectral function for theproton-knockout reaction ^{6}Li($e,e'p$) has beenmeasured in parallel kinematics in the missing-momentum range −100<p_m<200 MeV/c. The data below αbreakup are well described by a three-body (αnp) model of^{6}Li. The shell model with discrete energy eigenstates cannotdescribe the data. The experimental spectroscopic strength below αbreakup amounts to 0.79(10), compared to 0.87 as predicted by the three-bodymodel and 1.33 as calculated from a schematic harmonic-oscillator shell model.The discrepancy between the predictions of the two models is discussed.

6514 Nuclear Properties and Reactions, A=20-38, Experimental

Refer also to citation(s) 32670, 32695

32661 (ANU-P–981) **Studies of the T/sub Z/= 5/2 nuclei /sup 31/Al and /sup 29/Mg.** Woods, C.L.; Catford, W.N.; Fifield, L.K.; Orr, N.A.; Sadleir, R.B. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Oct 1987. 38p. Order Number DE89615827/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The multi-nucleon transfer reactions /sup 30/Si(/sup 18/O, /sup 17/F)/sup 31/Al and /sup 30/Si(/sup 13/C, /sup 14/O)/sup 29/Mg have been investigated at incident energies of 100 and 93 MeV respectively and a mean reaction angle of 8 deg. Excited states of the T/sub z/=5/2 /sup 31/Al and /sup 29/Mg have been studied and a mass excess of -14.967±0.025 MeV obtained for the ground state of /sup 31/Al. The /sup 28/Si(/sup 18/O, /sup 17/F)/sup 29/Al and /sup 28/Si(/sup 13/C, /sup 14/O)/sup 27/Mg reactions have also been studied, enabling conclusions to be drawn concerning the probable structure of many of the states observed in /sup 31/Al and /sup 29/Mg. Several 0 Planck constant ω levels predicted in recent complete sd shell calculations have been assigned experimental counterparts for the first time. The results also support a previous suggestion that negative parity states occur in /sup 29/Mg at 1.10 and 1.46 MeV.

32662 (ANU-P–1007) **Mass of /sup 37/P.** Fifield, L.K.; Chapman, R.; Durell, J.L.; Mo, J.N.; Smith, R.J.; Woods, P.J.; Fulton, B.R.; Cunningham, R.A.; Drumm, P.V. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Mar 1988. 14p. Order Number DE89615826/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The mass excess of /sup 37/P has been measured using the /sup 48/Ca (/sup 36/S, /sup 37/P)/sup 47/Sc reaction at E=198 MeV. A value of -19.06±0.12 MeV was obtained. This value is compared with two recent measurements and with the predictions of mass formulae.

32663 (CRN-PN–86-31) **Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity.** Lott, B. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). 1986. 90p. (In French). Order Number DE89776439/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

The excitation energy sharing between the fragments of a heavy ion collision has been studied for quasi-elastic and deep inelastic mechanisms. A /sup 32/S beam of 232 MeV incident energy has been used to bombard several targets (S,/sup 58/Ni, /sup 93/Nb). The evaporated charged particle multiplicities have been measured by inclusive measurements of the projectile-like nuclei and exclusive measurements of the two final nuclei. Evaporation calculations using the Hauser-Feshbach formalism allows us to deduce from the multiplicity measurements the projectile-like excitation energy. These results are compatible with the assumption of an equal sharing of excitation energies for quasi-elastic reaction products, and with the assumption of a mass ratio sharing for fully relaxed reaction products. Limiting values for the relaxation time of this mode have been deduced and are in agreement with predictions from the model developed by Randrup.

32664 (IPNO-DRE–88-12) **Neutron-hole strengths and core-coupling in /sup 87/Sr via the /sup 88/Sr(/sup 3/He, α)/sup 87/Sr reaction.** Fortier, S.; Gales, S.; Hourani, E.; Maison, J.M.; Schapira, J.P.; Massolo, C.P. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 26p. Order Number DE89776490/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Neutron-hole states in /sup 87/Sr were studied by means of the /sup 88/Sr(/sup 3/He,α)/sup 87/Sr reaction at 36 MeV. Angular distributions measurements were carried out from 3/sup 0/to 41/sup 0/(lab) and analysed with the zero-range distorted wave Born approximation method. Spectroscopic factors have been determined for about fifty discrete levels in /sup 87/Sr located below 6 MeV excitation energy and for the three lowest isobaric analog states 2p3/2, 1f5/2 and 2p1/2 observed around 11 MeV. Many 1=1 and 1=3 discrete levels are observed in the 3 to 6 MeV excitation energy range. In addition, a large part of the 1f-2p strength is found to lie in the higher-lying continuum up to 13 MeV (about 10 % and 40 % for the 1=1 and 3 contributions, respectively). The distribution of the 1f-2p neutron hole strength is compared to previous data on neighbouring nuclei /sup 89/Zr and /sup 91/Mo. In addition, angular distributions for some low-lying high-spin states in /sup 87/Sr are nicely reproduced by coupled-channel calculations which assume pure two-step (inelastic + g9/2 transfer) processes. Spin-parity assignments are proposed for the levels at 1.92 MeV (7/2/sup +/), 2.16 MeV (11/2/sup +/), 2.55 MeV (9/2/sup -/) and 2.60 MeV (13/2/sup -/), on the ground of this coupled-channel analysis.

6515 Nuclear Properties and Reactions, A=39-58, Experimental

Refer also to citation(s) 32663

32665 (INIS-mf–11948) **Density-depending time-differential perturbed angular correlation in gas-phase /sup 111/InCl.** Armbrecht, L. Goettingen Univ. (Germany, F.R.). Fachbereich Physik. 5 Jul 1985. 60p. (In German). Order Number DE89774670/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

In the present thesis the perturbation of the 171-245 keV γ-γ-cascade in /sup 111/Cd after electron capture decay of /sup 111/In was investigated by TDPAC with gas-phase radioactive /sup 111/InCl. A strong dependence of the damping coefficient G/sub 22/(t) on density was found. It could be shown that by TDPAC collision cross sections below 1 eV can be measured. (BHO).

32666 (KIYI–88-4) **Study on isomeric ratios in the /sup 45/Sc(γ,n)/sup 44mg/Sc and /sup 44/Ca(p,n)/sup 44mg/Sc reactions.** Vishnevskij, L.N.; Zheltonozhskij, V.A.; Iomonosov, V.I. and others. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 12p. (In Russian). Order Number DE89615828/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The isomeric ratios σm/σg are determined in the /sup 45/Sc(γ,n)/sup 44mg/Sc reactions in the energy region of 11-20 MeV and in /sup 44/Ca(p,n)/sup 44mg/Sc in the energy region of 4-7 MeV. The cross section σm of photoexcitation of /sup 44m/Sc isomer is obtained using the isomeric ratios in the (γ,n) reaction. Experimental isomeric ratios are compared with calculations by statistic theory of Fermi gas. 15 refs.; 4 figs.

32667 **Contribution of nucleon transfer to the elastic scattering of ^{28}Si+^{58,64}Ni near the Coulomb barrier.** Sugiyama, Y. (Department of Physics, Japan Atomic Energy Research Institute, Tokai-mura, Ibaraki-ken 319-11, Japan(JP)); Tomita, Y.; Ikezoe, H.; Ideno, K.; Fujita, H.; Sugimitsu, T.; Kato, N.; Kubono, S.; Landowne, S. *Physical Review Letters (USA),* 62(15): 1727-1730 (10 Apr 1989).

Quasielastic-scattering cross sections of^{28}Si+^{58,64}Ni have been measured inthe energy range $E_{c.m.}$=50.0–76.5 MeV. The transfer-channels with a large cross section produce a considerable effect on theelastic scattering for ^{28}Si+^{64}Ni, while theeffect is small for ^{28}Si+^{58}Ni because of thesmall transfer yield. A coupled-channels

calculation including one neutrontransfer and inelastic excitation explains well not only the energy dependencebut also the isotope dependence of the quasielastic scattering with a singleenergy- and isotope-independent bare potential.

32668 Fusion of ^{16}O + ^{40}Ca at $E_{lab}(^{16}O)$=13.4 MeV/nucleon. Beck, C. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439(US)); Kovar, D. G.; Sanders, S. J.; Wilkins, B. D.; Henderson, D. J.; Janssens, R. V. F.; Ma, W. C.; Vineyard, M. F.; Wang, T. F.; Maguire, C. F.; and others. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2202-2221 (Jun 1989). DOE Contract W-31-109-ENG-38.

Mass and velocity distributions have been measured for the evaporationresidue and fusion-fission products from the^{16}O+^{40}Ca reaction at 214 MeV. Comparisons ofMonte Carlo statistical evaporation simulations to the observed angle and massdependences of the evaporation-residue velocity distributions were used to setlimits on the maximum complete-fusion cross section and to extract informationabout the magnitude and character of incomplete-fusion processes. The extractedvalue of the complete fusion evaporation-residue cross section is discussed inthe framework of previous results and existing models.

6516 Nuclear Properties and Reactions, A=59-89, Experimental

Refer also to citation(s) 32565, 32667

32669 (IPNO-DRE–88-11) **Decay of /sup 183/Ir shape of / sup 183/Os and /sup 185/Pt in their low-spin states.** Roussiere, B.; Bourgeois, C.; Kilcher, P.; Sauvage, J.; Porquet, M.G.; Wojtasiewicz, A.; Isocele Collaboration. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1988. 35p. Order Number DE89776489/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The decay of /sup 183/Ir has been studied with mass-separated sources from the ISOCELE facility. A level scheme of /sup 183/Os has been established. It is discussed in the framework of an 'axial-rotor+quasi-particle' model: all the states located below 700 keV are interpreted assuming a prolate shape of the nucleus. This study has shed a new light on the interpretation of the /sup 185/Pt low-spin states. Very converted transitions in /sup 185/Pt are discussed.

32670 (LBL–27019) **The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission.** Moretto, L.B.; Bowman, D.R.; Colonna, N.; Wozniak, G.J. Lawrence Berkeley Lab., CA (USA). Apr 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8904153–1: Symposium on nuclear dynamics and nuclear assembly, Dallas, Texas, USA, 9-14 Apr 1989). Order Number DE89011823/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The incomplete fusion process is affected by the entrance channel asymmetry as well as by the bombarding energy. In the first part of the paper, the role of entrance channel mass asymmetry is explored by characterizing the resulting complex fragment sources in terms of their velocity, charge and excitation energy. In the second part evidence is given about the possible demise of incomplete fusion and the onset of the fireball regime from the anomalous charge and angular distributions of the emitted complex fragments. Complete ternary events are analyzed and discussed in terms of sequential binary decay. 14 refs., 8 figs.

32671 Isobaric yield curves at *A*=72 from the spallation of medium mass isotopes by intermediate energy protons. Tobin, M. J. (Department of Radiation Health, University of Pittsburgh, Pittsburgh, Pennsylvania 15261(US)); Karol, P. J. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2330-2338 (Jun 1989).

Cross sections of radionuclides in the *A*≈72 mass region produced by the interaction 800 MeV protons with ^{89}Y, $^{92,96,100}Mo$, and ^{130}Te were measured. Particular emphasis was paid to the measurement of short-lived products far from β stability. The cross sections were used to generate isobaric yield curves at *A*=72. Precise characterization of these curves showed that the distribution parameters (mean, standard deviation, skewness) vary in a regular fashion with target *N/Z*. For ^{89}Y, relative isobaric curves produced by 500 and 800 MeV protons were found to be identical within experimental error. The yield distributions for the $^{92,96,100}Mo$ targets also scaled with those from an earlier alpha-induced spallation study. These findings lend strong support to the argument that the spallation mechanism is independent of projectile energy and target composition.

6517 Nuclear Properties and Reactions, A=90-149, Experimental

Refer also to citation(s) 32671

32672 (GSI–89-08) **Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier.** Bellwied, R. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Mainz Univ. (Germany, F.R.). Mar 1989. 126p. (In German). Order Number DE89774821/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

For the fusion of heavy atomic nuclei the nuclear-charge product exceeds Z/sub 1/Z/sub 2/=1600 in experiments at the Coulomb barrier a dynamical hindrance was detected. For the study of all binary reaction channels first /sup 86/Kr induced reactions with /sup 76/Ge, /sup 104/Ru, and /sup 130/Te were radiochemically studied. The relative to the fusion still unhindered system Kr+Ge shows beside the fusion only the transfer of few nucleons between projectile and target. In the reactions with Ru and Te (onsetting fusion hindrance) goes indeed a certain part (about 20%) of the missing fusion cross section in reactions with large mass flux, on the other hand however a sudden increasing of the quasi-elastic transfer of few nucleons strikes which fits well into the trend of the literature data for lighter and heavier systems and signalizes a sharply localized correlation between the vanishing of the fusion and the increasing of the transfer. In order to study further this threshold behaviour and to get additional kinematical informations on the binary reaction channels the reactions /sup 96/Zr+/sup 90/Zr and /sup 124/Sn+/sup 96/Zr were measured at the magnetic spectrometer of the GSI. With the spectrometer it is contrarily to the radiochemical experiments possible to determine fourfold differential cross section distributions. The sudden increasing of the cross section for quasi-elastic transfer at the threshold for fusion hindrance is completely confirmed whereby from measurements of the energy loss in the exit channel follows that (with lower weight) also complex transfer channels with essential energy damping are formed. By these experiments it has been shown for the first time that the dynamical fusion hindrance already onsets before the collisional partners reach the barrier. (orig./HSI).

32673 (LUTHD2-TFKF–1010-1-103-1988) **Study of beta decay energies and atomic masses.** Spanier, L. Lund Univ. (Sweden). Dept. of Nuclear Physics. Apr 1988. 33p. Order Number DE89613006/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The q/sub β/energies of /sup 123-131/In have been determined using the end points of β spectra recorded in β-γ coincidence experiments. A HPGe planar detector was used to detect the β-particles and a semi-empirical response function was used when unfolding the electron distribution. The mass excesses were deduced and when they were compared with the predictions of various mass formulae, the cadmium isotopes were found to be heavier than those predicted by most of the mass formulae. The excitation energy of the 1/2/sup -/proton-hole state in the odd indium isotopes was shown to be constant for all the heavy isotopes. The Q/sub EC/energies of /sup 148/Dy and /sup 96/Pd were determined using the β/sup +//EC intensity ratio method. The ratio of the intensity of the /sup β+/branch to the total beta decay intensity was determined by means of γ-spectroscopic methods. The mass excesses were deduced. The two-proton binding energy for the N=82 isotones showed only a small step of approximately 0.5 MeV when the doubly-magic nucleus /sup 146/Gd was encountered. A liquid drop type mass formula with deformation and shell energy corrections and with few free parameters is presented. The shell energy correction is a simple analytical expression for the equilibrium deformation of the nucleus. An analytical expression for the equilibrium nuclear deformation is also presented. The mass formula was applied to nuclei with Z and N greater than 50. The RMS deviation is 0.55 milli

mass units. The reaction /sup 98/Mo(p,n)/sup 98/Tc was investigated through the counter ratio method, the ratio of the number of slow neutrons to the number of fast neutrons. The Q/sub pn/energy value of a low-spin state in /sup 98/Tc was determined. The state at 90.9 keV excitation energy is proposed to be the 14.6 /sup m/u/sup s/isomer and have spin and parity 1/sup +/.

6518 Nuclear Properties and Reactions, A=150-189, Experimental

32674 (ANU-P–969) **Observation of sub-barrier fusion enchancement due to negative hexadecapole deformations.** Leigh, J.R.; Bokhorst, J.J.M.; Hinde, D.J.; Newton, J.O. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Jan 1988. 14p. Order Number DE89615833/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Fusion excitation functions for /sup 16/O on /sup 176/Hf, /sup 180/Hf and /sup 182/W, /sup 184/W, /sup 186/W have been measured over an energy range spanning the fusion barrier. Contrary to expectation, the sub-barrier cross-sections are systematically lower for the nuclei with larger quadrupole deformations, β 2. These cross-sections are also significantly higher than those calculated using a model which takes β 2 deformations into account; similar comparisons for other reactions, including /sup 16/O on /sup 152/Sm,/sup 154/Sm show no such enhancement. We suggest that fusion enhancement due to the negative hexadecapole deformations of the Hf and W nuclei may have been observed for the first time.

32675 (INIS-SU–78, pp. 225-228) **Measurement of total neutron cross sections for /sup 152/Gd and /sup 153/Gd(T/sub 1/2/=242 days).** Anufriev, V.A. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)); Babich, S.I.; Masyanov, S.M. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The measurements of the total neutron cross section for /sup 152/Gd and /sup 153/Gd(T/sub 1/2/=242d) were carried out the energy range of (0.02-200)eV. Resonance parameters for ten levels of /sup 152/Gd and nine levels of /sup 153/Gd were calculated. The burnup effective cross sections were performed. 7 refs.; 3 tabs.

32676 **^{148}Gd(p,t)^{146}Gd reaction: Neutron states in ^{146}Gd.** Mann, L. G. (Nuclear Chemistry Division, Lawrence Livermore National Laboratory, Livermore, California 94550(US)); Lanier, R. G.; Struble, G. L.; Yates, S. W.; Naumann, R. A.; Kouzes, R. T. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2180-2189 (Jun 1989). DOE Contract W-7405-ENG-48.

We have used the^{148}Gd(p,t)^{146}Gd reaction withprotons of 34.6 and 24.9 MeV to study levels in ^{146}Gd belowE_x=5.6 MeV. The radioactive target material was deposited on thecarbon support foil from an isotope separator. Triton spectra were analyzed bya magnetic quadrupole-dipole-dipole-dipole spectrometer (Q3D) at 11 anglesbetween 10° and 60°. By comparing the angular distributionswith the results of distorted-wave Born approximation calculations we obtaineddefinitive L-transfer values for 11 excited states, including a stronglypopulated 0$^+$ state at 4534 keV, and approximate L valuesfor about 50 additional states. A search for members of the two-octupole-phononquartet of states expected to occur at ~3.2 MeV of excitation (twicethe single-phonon energy) revealed no convincing evidence of the0$^+$ component, but the 2$^+$ component could be oneof the four new 2$^+$ states identified in this region. Acomparison between the most strongly populated low-lying states of^{142}Sm in the ^{144}Sm(p,t)reaction and states in the pairing-vibrational region of^{146}Gd reveals a possible set of states whose energies and(p,t) cross sections are in reasonable agreement withpredictions of the harmonic pairing-vibration model.

6519 Nuclear Properties and Reactions, A=190-219, Experimental

Refer also to citation(s) 32683, 32687

32677 (ANU-P–983) **Coulomb excitation of the 4/sup +//sub 1/states of /sup 194/Pt, /sup 196/Pt and /sup 198/Pt.** Fewell, M.P.; Gyapong, G.J.; Spear, R.H. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Sep 1987. 23p. Order Number DE89615836/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Probabilities for the Coulomb excitation of the 4/sub 1//sup +/ states of /sup 194/Pt, /sup 196/Pt, /sup 198/Pt by the backscattering of /sup 4/He, /sup 12/C and /sup 16/O ions are reported. Model-independent values of the matrix elements <0/sub 1//sup +/; M(E4), 4/sub 1//sup +/> and <2/sub 1//sup +/, M(E2), 4/sub 1//sup +/> are extracted. Agreement with previous measurements of these matrix elements is good. Values of β/sub 2/and β/sub 4/are determined for /sup 194/Pt and compared with calculations of these quantities.

32678 (ANU-P–990) **Spectroscopy and octupole coupling of high-spin states in /sup 213/Rn.** Stuchbery, A.E.; Dracoulis, G.D.; Byrne, A.P.; Poletti, S.J.; Poletti, A.R. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Feb 1988. 57p. Order Number DE89615837/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Excited states of /sup 213/Rn, up to spins of ~ 55/2 Planck constant and an excitation energy of ~ 6 MeV, have been studied using γ-ray and electron spectroscopy following the reactions /sup 208/Pb(/sup 9/Be,4n) and /sup 204/Hg(/sup 13/C,4n). Eight isomeric states were identified and g-factors for five of these measured by the TDPAD technique. Several of the isomeric states decay by enhanced E3 transitions. The level scheme and electromagnetic properties of the isomers are compared with the results of semi-empirical shell-model calculations including calculations which explicitly account for the particle-octupole vibration coupling.

32679 (ANU-P–1000) **Electric quadrupole moments of the first excited state of /sup 192/Os.** Lim, C.S.; Spear, R.H.; Vermeer, W.J.; Fewell, M.P.; Gyapong, G.J. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. May 1988. 28p. Order Number DE89615835/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Coulomb excitation by /sup 4/He and /sup 12/C projectiles has been used to determine electric quadrupole moments of the first excited state of 2/sup 192/Os. It is found that B(E2;0/sub 1//sup +/-> 2/sub 1//sup +/) = 2.030(13)e/sup 2/b/sup 2/, in excellent agreement with previous work. The static moment Q(2/sub 1//sup +/) is found to have the value -0.86 (20) e. b, in good agreement with the result of a muonic x-ray experiment.

32680 (DOE/ER/40467–2) **Transverse momentum distributions and particle correlations from EMU05.** Takahashi, Y.; Chan, C.H.; Duthie, J.G.; Gregory, J.C.; Hayashi, T.; Yokomi, H.; Derrickson, J.H.; Eby, P.B.; Fountain, W.F.; Parnell, T.A. Alabama Univ., Huntsville, AL (USA). 1988. 5p. Sponsored by DOE Energy Research. DOE Contract FG05-88ER40467. (CONF-8809203–9: Quark Matter '88: 7th international conference on ultrarelativistic nucleus-nucleus collisions, Lenox, Massachusetts, USA, 26-30 Sep 1988). Order Number DE89013578/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Transverse momentum distributions and multi-particle correlations of charged particles in 200 GeV/AMU heavy-ion collisions are studied with the Magnetic-Interferometric-Emulsion-Chamber (MAGIC) for central collision events in ^{16}O + Pb and ^{32}S + Pb interactions. The P_T distribution of negative-charged particles below 1 GeV/c fits a single exponential, while that of positive particles contains additional contributions of both high and low-P_T particles. The like-sign, two particle correlations indicate HBT interferences, while that of the unlike-sign pairs possibly suggests other components. The apparent, multi-particle, charge-sign clustering is studied with the run-test and with Monte Carlo simulations. Some of the data are consistent with chance coincidence and the HBT interference. 6 refs., 6 figs.

32681 (UCRL–100825) **Fission in intermediate energy heavy ion reactions.** Wilhelmy, J.B.; Begemann-Blaich, M.; Blaich, T.;

Boissevain, J.; Fowler, M.M.; Gavron, A.; Jacak, B.V.; Lysaght, P.S.; Britt, H.C.; Fields, D.J. Lawrence Livermore National Lab., CA (USA). Apr 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890491–6: International conference on fifty years of research in nuclear fission, Berlin, Germany, F.R., 3-7 Apr 1989). Order Number DE89012295/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A systematic study of reaction mechanisms at intermediate energies (50–100 MeV/A) has been performed at the Lawrence Berkeley Laboratory's BeValac using medium weight projectiles on medium and heavy element targets. A gas and plastic phoswich detector system was employed which gave large geometric coverage and a wide dynamic response. The particles identified with the gas detectors could be characterized into three components–intermediate mass fragments (IMF), fission fragments (FF) and heavy residues (HR). Major observed features are: the reaction yields are similar in the 50 to 100 MeV/A range, central collisions have high multiplicity of IMF's with broad angular correlations consistent with a large participant region, effects of final state Coulomb interactions are observed and give information on the size and temporal behavior of the source, true fission yields are dependent on target fissility and correlated with relatively peripheral collisions. Analysis of fission and evaporation yields implies limiting conditions for which fission decay remains a viable deexcitation channel. 15 refs., 7 figs.

32682 **Electromagnetic decay of 10/sup +/states and yrast isomers in /sup 208/Pb.** Roy, N. (Lawrence Livermore National Lab., CA (USA)); Maier, K.H.; Aprahamian, A.; Becker, J.A.; Decman, D.J.; Henry, E.A.; Mann, L.G.; Meyer, R.A.; Stoeffl, W.; Struble, G.L. *Physics Letters [Section] B (Netherlands),* 221(1): 6-10 (20 Apr 1989). DOE Contract W-7405-ENG-48.

Gamma decay of the four previously known 10/sup +/states between 4.8 and 5.9 MeV of excitation in /sup 208/Pb, and isomerism of the lowest 10/sup +/[T/sub 1/2/=500(50) ns] and 8/sup +/[T/sub 1/2/=3.2(5) ns] states have been established with α-γ coincidence measurements in /sup 209/Bi (t, $\alpha\gamma$)/sup 209/Pb. Wavefunctions for the 10/sup +/states were deduced in the model space involving 1p-1h excitations only. These show that the πh/sub 9/2/h/sub 11/2//sup -1/strength is nearly evenly distributed among the 10/sup +/states, in disagreement with results from (e, e') data.

6520 Nuclear Properties and Reactions, A=220 and Above, Experimental

Refer also to citation(s) 30857, 32713

32683 (INDC(CCP)–292/L) **Translation of selected papers published in Nuclear Constants 2, 1985.** International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. 40p. Order Number DE89613030/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-248/G.

The document contains 7 papers translated from Russian and published in Nuclear Constants 2, 1985. A separate abstract was prepared for each of these papers. Figs and tabs.

32684 (INDC(CCP)–292/L, pp. 11-13) **Angular anisotropy of fragments of /sup 235/U fission induced by 0.014-7.15 MeV neutrons.** Androsenko, Kh.D.; Korolev, G.G.; Shpak, D.L. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. In *Translation of selected papers published in Nuclear Constants 2, 1985.* Order Number DE89613030/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Original report in Russian was distributed as INDC(CCP)-248/G.

The angular anisotropy of /sup 235/U fission fragments was studied in the neutron energy range 0.014-7.15 MeV using glass detectors. The angular distribution was fitted by cos θ quadratic dependence and the results are compared with those of other authors.

32685 (INDC(CCP)–292/L, pp. 27-30) **Evaluation of the energy dependence of the average number of prompt neutrons 4u-bar p for neutron-induced fission of /sup 235/U in the 0-20 MeV energy range.** Malinovskij, V.V.; Tarasko, M.S. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. In *Translation of selected papers published in Nuclear Constants 2, 1985.* Order Number DE89613030/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Original report in Russian was distributed as INDC(CCP)-248/G.

The most detailed sets 4u-barp (average number of prompt neutrons) were used for the evaluation of their energy dependence in the neutron induced fission of /sup 235/U in the energy range up to 20 MeV. The least-squares fitting procedure was applied for each data set to derive segmented straight lines. The final estimates were made by the least squares method, including systematic experimental errors. A comparison with other evaluations is performed. 2 figs, 2 tabs.

32686 (INDC(CCP)–292/L, pp. 31-34) **Experimental determination of resonance self-shielding factors affecting the neutron radiative capture cross-section for /sup 238/U in the 10 to 140 keV energy range.** Kononov, V.N.; Poletaev, E.D.; Bokhovko, M.V.; Kazakov, L.E.; Timokhov, V.M.; Voevodskij, A.A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. In *Translation of selected papers published in Nuclear Constants 2, 1985.* Order Number DE89613030/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Original report in Russian was distributed as INDC(CCP)-248/G.

A method for experimental determination of capture self-shielding factors in the neutron radiative capture cross-section for /sup 238/U in the energy range 10-140 KeV is described. The method is based on simultaneous measurement of the transmission and the capture self-indication using a pulsed Van de Graaff accelerator and the time-of-flight technique. The results obtained are in agreement with the data for the group constants BNAB. 1 fig., 2 tabs.

32687 (INDC(CCP)–292/L, pp. 35-40) **Measurement of the neutron radiative capture cross-sections for /sup 236/U and /sup 197/Au in the 3-420 keV energy range.** Kazahov, L.E.; Kononov, V.N.; Poletaev, E.D.; Bokhovko, M.V.; Voevodskij, A.A.; Timokhov, V.M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. In *Translation of selected papers published in Nuclear Constants 2, 1985.* Order Number DE89613030/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Original report in Russian was distributed as INDC(CCP)-248/G.

The neutron radiative capture cross-sections for /sup 236/U and /sup 197/Au in the energy range 3-420 KeV were obtained. The measurements were carried out at a pulsed Van de Graaff accelerator using the time-of-flight technique. The saturated resonance was used for calibration and the /sup 6/Li(n,α)/sup 3/H and /sup 10/B(n,$\alpha\gamma$)/sup 7/Li cross-sections for flux shape. 2 figs, 3 tabs.

32688 (INDC(CCP)–293/L) **Translation of selected papers published in Nuclear Constants 3, 1985.** International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. 57p. Order Number DE89613037/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-252/G.

The document contains 4 papers translated from Russian and published in Nuclear Constants 3, 1985. A separate abstract was prepared for each of these papers. Figs and tabs.

32689 (INDC(CCP)–293/L, pp. 5-17) **Absolute measurements of the prompt neutron spectrum produced by spontaneous fission of /sup 252/Cf in the low-energy region.** Dyachenko, P.P.; Seregina, E.A.; Kutsaeva, L.C.; Lajtai, A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. In *Translation of selected papers published in Nuclear Constants 3, 1985.* Order Number DE89613037/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Original report in Russian was distributed as INDC(CCP)-252/G.

The energy spectrum of the neutrons produced by the spontaneous fission of /sup 252/Cf was measured in the energy region 0.02-1.22 MeV by the time-of-flight method using an ionization chamber and lithium glasses to detect the fission fragments and neutrons, respectively. A detailed description of the measurement method and the procedures used for data processing is given. 6 figs.

32690 (INDC(CCP)–295/L) **Evaluated nuclear constants for uranium-236 (Preprint No. 2).** Klepatskij, A.B.; Kon'shin, V.A.; Maslov, V.M.; Porodzinskij, Yu.V.; Sukhovitskij, E.Sh. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. 57p. Order Number DE89613040/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Translated by the IAEA.

New results are presented for the evaluation of the data for neutron interaction with /sup 236/U. A complete system is given for evaluated neutron data in the neutron energy range 10/sup -5/-20 MeV, established using up-to-date theoretical models. Application of the coupled-channel method and of a statistical model with correct calculation of the transmission coefficients and level density of nuclei, together with the use of new experimental data, have made it possible to enhance the reliability of neutron cross-section evaluation for /sup 236/U. (author). 72 refs, 6 figs, 6 tabs.

32691 (INIS-SU–78, pp. 175-178) **Total neutron cross sections and average resonance parameters of uranium 238.** Vertebnyj, V.P. (AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij); Libman, V.A.; Litvinskij, L.L.; Muravitskij, A.V.; Murzin, A.V.; Novoselov, G.M.; Razbudej, V.F.; Sidorov, S.V.; Trofimova, N.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 14-18 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Uranium 238 total neutron cross sections have been measured at 2, 24, 53, 144 keV neutron energies. S/sub 0/, R/sub 0/' average resonance parameters, where S/sub 0/- s-strength function, R/sub 0/' - optimal scattering length, of uranium 238 have been determined. 8 refs.; 2 figs.

32692 (SAND–89-1101C) **Gamma-ray emission probabilities of the daughters of ^{238}U.** Scott, H.L.; Marlow, K.W. Sandia National Labs., Albuquerque, NM (USA). 1989. 17p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890658–1: International symposium on nuclear decay data: spectrometric methods, measurements and evaluations, Braunschweig, Germany, F.R., 6-8 Jun 1989). Order Number DE89011844/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the past several years a wealth of decay data has been obtained and reported, much of it in "Decay Data of the Transactinium Nuclides", IAEA Technical Reports Series No. 261 (1986). The decay data for the daughters of ^{238}U have been notable by their absence in such compilations; and since there is a need for such data, a set of experiments has been performed to measure the gamma-ray emission probabilities. Uranium samples of known mass and isotopic concentration in aqueous solution are analyzed with a high-purity germanium gamma-ray spectrometer. Various samples have also in solution multi-line calibration sources with well-known relative intensities. The well-known emission probabilities of the ^{235}U gamma rays are used to provide an absolute intensity reference. Since self-absorption of the sample is included in the effective detector efficiency, there is not need for a separate calculation of this absorption. Gamma-ray emission probabilities for the energy range 63 to 1938 keV are reported. Sources of error, including those in the efficiency curve, are discussed. 11 refs., 5 figs., 4 tabs.

32693 **Heavy-fragment radioactivity of ^{234}U.** Moody, K. J. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94551(US)); Hulet, E. K.; Wang, S.; Price, P. B. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2445-2447 (Jun 1989). DOE Contract AC03-76SF00098.

Earlier we reported the detection of three events in which ^{234}U decayed by Mg-ion emission and 14 events in which it decayed by Ne-ion emission. In a new experiment with a factor of 7 longer exposure time, we have detected 36 Mg fragments and 108 Ne fragments. From the larger number of events, we have made a more accurate determination of the branching ratios relative to alpha decay, taking into account zenith-angle-dependent detection efficiency. The result is $\log_{10}B(Ne/\alpha)=-12.36\pm0.05$ and $\log_{10}B(Mg/\alpha)=-12.86\pm0.08$.

6530 Nuclear Theory

Refer also to citation(s) 32668, 32683, 32688

32694 (ANU-P–984) **Recent developments in heavy-ion induced fission.** Newton, J.O. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Aug 1987. 28p. Order Number DE89615813/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Results of a detailed statistical model analysis of data on nuclei with a wide range of fissility are presented. Measurements of pre-fission neutrons deviate from the statistical model predictions, and the implications of these regarding nuclear dynamics and the statistical model parameters are discussed.

32695 (ANU-P–995) **/sup 20/Ne(/sup 16/O, /sup 16/O)/sup 20/Ne excitation function at θ/sub CM/= 90 deg. and parity - dependent interactions.** Hebbard, D.F.; Nurzynski, J.; Ophel, T.R.; Drumm, P.V.; Konoto, Y.; Robson, B.A.; Smith, R. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Jan 1988. 20p. Order Number DE89615774/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The excitation function for /sup 16/O + /sup 20/Ne elastic scattering at θ/sub CM/= 90 deg. has been measured over the energy range between 21.5 MeV and 31.2 MeV and analysed within the framework of an extended optical model, in order to place additional constraints on spin assignments to resonant states, and hence constraints on the parity dependent part of the /sup 16/O - /sup 20/Ne potential. A satisfactory description is obtained of elastic scattering excitation functions at θ/sub CM/. = 154 deg. $\pm$ 2 deg. with a potential which is deeper for even than for odd partial waves. Such a parity dependence is consistent with the assumption that this term arises from a requirement to simulate the effects of α-transfer amplitudes, and with the expectations of models which argue that parity dependence is to be expected as a consequence of the Pauli principle.

32696 (CONF-890406–18) **Fission theory: Its relevance to the nuclear cross section data base.** Lynn, J.E. Argonne National Lab., IL (USA). 1989. 12p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Fifty years with nuclear fission conference; Gaithersburg, Maryland, USA; 25-28 Apr 1989. Order Number DE89013277/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The development of fission reaction theory in relation to its predictive power in the calculation of neutron cross-sections is reviewed. The topics covered include the transition state spectrum and the channel theory; the discovery of complex topography in the fission barrier and the consequences of intermediate structure in fission cross-sections; the evidence of experimental data in parameterizing the fission barrier; and the role of other aspects of collective nuclear motion in controlling fission reaction rates. 51 refs., 6 figs.

32697 (CRN-PN–83-22) **Particle evaporation-fission competition in nuclear fission considered as a diffusion process.** Hassani, S. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). 1983. 62p. (In French). Order Number DE89776426/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

Nuclear fission is treated as a diffusion process in phase space corresponding to the essential collective variable of fission. The solution of the two-dimensional Fokker-Planck equation is used to obtain an escape rate over the collective potential barrier. This escape rate over the barrier presents a transient regime, the asymptotic value of which is identified to the fission width given by the usual statistical model. This time dependent fission width is included in a schematic formalism for the deexcitation of the compound nucleus to calculate the multiplicities of pre-fission neutrons. A sensitive dependence of the multiplicities on the friction and an enhancement of the multiplicities with respect to the standard statistical model at high energy are obtained.

32698 (CRN-PN–85-30) **Contribution to the determination of nuclear friction by studying the de-excitation of nuclei in the transient regime.** Hassani, S. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France).

1985. 63p. (In French). Order Number DE89776427/JAW. Available from NTIS (US Sales Only), PC A04/MF A01.

An old idea of Kramers is to consider nuclear fission as a diffusion process in phase space corresponding to the collective variable of fission. The fission width is taken as an escape rate of the system over the barrier potential. The evolution of the distribution of this collective variable and its conjugate is governed by a Fokker-Planck equation. In a quasistationary treatment Kramers obtained a fission rate which differs from the result given by the transition state method by a friction dependent factor. The non quasistationary solution of the Fokker-Planck equation allows to obtain an escape rate that presents a transient regime: from zero it grows and reaches asymptotically the Kramers' value. This time-dependent fission width is included in a formalism that describes the deexcitation of the compound nucleus in order to calculate the neutron multiplicities in competition with fission. A sensitive friction-dependence of the multiplicities is obtained. Using this formalism and comparing the results with data of a recent experiment gives a good agreement; resolving the disagreement between data and the usual statistical model at high energy. A range of values of the friction coefficient is deduced.

32699 (CRN-PN–86-26) **Study of shape changes of rotating nuclei.** Menas, F. Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Strasbourg-1 Univ., 67 (France). 1986. 163p. (In French). Order Number DE89776434/JAW. Available from NTIS (US Sales Only), PC A08/MF A01.

The systematic calculation of the rotational band heads was performed for $65 < Z < 81$ nuclei. The equilibrium deformations have been determined for each band-head separately and a comparison with several hundreds of levels known experimentally has been given. Also, the calculations of the total energy surfaces with pairing using the mean-pairing field ansatz have been given. The first results were illustrated on the shape-coexistence effects in N = 87 isotones.

32700 (DOE/ER/10353–T1) **Computational methods for the nuclear and neutron matter problems: Progress report.** Kalos, M.H. New York Univ., NY (USA). Courant Inst. of Mathematical Sciences. [1989]. 16p. Sponsored by DOE Energy Research. DOE Contract AC02-79ER10353. Order Number DE89013504/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses: the application of Monte Carlo methods to solve nuclear structure problems; calculation methods of wave functions for a droplet of He atoms; and choosing optimal nodal surfaces. (LSP)

32701 (DOE/ER/10353–T2) **Computational methods for the nuclear and neutron matter problems: Progress report.** Kalos, M.H. New York Univ., NY (USA). Courant Inst. of Mathematical Sciences. [1989]. 9p. Sponsored by DOE Energy Research. DOE Contract AC02-79ER10353. Order Number DE89013503/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses mirror potentials and the many-fermion problem, and variational Monte Carlo calculation of quark matter. (LSP)

32702 (DOE/ER/10353–T3) **Computational methods for the nuclear and neutron matter problems: Progress report.** Kalos, M.H. New York Univ., NY (USA). Courant Inst. of Mathematical Sciences. [1989]. 23p. Sponsored by DOE Energy Research. DOE Contract AC02-79ER10353. Order Number DE89013502/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This proposal is concerned with the use of Monte Carlo methods as a numerical technique in the study of nuclear structure. The straightforward use of Monte Carlo in nuclear physics has been impeded by certain technical difficulties. Foremost among them is the fact that numerical integration of the Schrödinger equation, by now straightforward for the ground state of boson systems, is substantially more difficult for many-fermion systems. The first part of this proposal outlines a synthesis of several advances into a single experimental algorithm. The proposed work is to implement and study the properties of the algorithm with simple models of few-body nuclei as the physical system to be investigated. Variational Monte Carlo remains an extremely powerful and useful method. Its application to nuclear structure physics presents unique difficulties. The varieties of interactions in the phenomenological potentials must be reflected in a corresponding richness of the correlations in accurate trial wave functions. Then the sheer number of terms in such trial fashions written as a product of pairs presents specific difficulties. We have had good success in our first experiments on a random field method that decouples the interactions and propose to extend our research to ^{16}O and to p-shell nuclei. Spin-orbit terms present special problems as well, because the implied gradient operators must be applied repeatedly. We propose to treat them in first order only, for now, and to calculate the result in three- and four-body nuclei. We propose a new Monte Carlo method for computing the amplitude of deuteron components in trial functions for heavier nuclei (here, specifically for ^{6}Li). The method is an extension of that used for off-diagonal matrix elements in quantum fluids.

32703 (DOE/ET/53088–369) **Influence of attractive interaction between deuterons in Pd on nuclear fusion.** Tajima, T.; Iyetomi, H.; Ichimaru, S. Texas Univ., Austin, TX (USA). Inst. for Fusion Studies. Apr 1989. 13p. Sponsored by DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–369). Order Number DE89013314/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

It is shown that in a heavily deuterated palladium metal a pair of deuterons exhibit attractive interaction at short distance (≈ 0.1 Å-0.7 Å) due to strong Coulomb correlations in the ion-sphere model and due to the screening action of localized 4d electrons. This mechanism leads to enhanced thermonuclear reactions at room temperatures some 50 orders of magnitude faster than that in a D_2 molecule. Characteristic signatures of predicted nuclear reactions are described. 17 refs., 2 figs., 1 tab.

32704 (GSI–89-23(prepr.)) **Correlations between dilepton yields and pion multiplicities as probe of the deconfinement transition.** Kaempfer, B.; Gorenstein, M.I.; Pavlenko, O.P. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. Feb 1989. 11p. Order Number DE89774711/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The correlation between dilepton yields and pion multiplicities in the baryon-poor central region produced in ultra-relativistic nucleus-nucleus collisions is analyzed within a hydrodynamical framework. A 'cut-in' in the correlation function is predicted as signal of the deconfinement transition. Transverse flow effects, finite hadronization times of the deconfined matter and realistic initial matter distributions enhance this signal.

32705 (GSI–89-24(prepr.)) **Monopole and quadrupole vibrations of a hot nucleus.** Okolowicz, J.; Drozdz, S.; Ploszajczak, M.; Caurier, E. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. Mar 1989. 30p. Order Number DE89774712/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

An extended time-dependent Hartree-Fock approach has been applied to a description of the isoscalar giant monopole and quadrupole vibration modes in the excited nuclear system at finite temperature. The temperature dependence of the resonance characteristics is established for both modes. In anticipation of some anharmonic effects the principle of regularity and single-valuedness has been used to extract the energies of the collective modes.

32706 (GSI–89-29(prepr.)) **Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions.** Albrecht, R.; Bock, R.; Gutbrod, H.H.; Kolb, B.W.; Lund, I.; Schmidt, H.R.; Siemiarczuk, T.; Awes, T.C.; Baktash, C.; Ferguson, R.L. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Oak Ridge National Lab., TN (USA); Muenster Univ. (Germany, F.R.). Inst. fuer Kernphysik; Tennessee Univ., Knoxville, TN (USA); Lund Univ. (Sweden). Dept. of Physics. Mar 1989. 18p. Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

Fluctuations in the pseudo-rapidity density of charged particles in /sup 16/O+(C, Au) reactions at 200 A GeV were analyzed with the method of scaled factorial moments. The extracted moments are proportional to a power of the pseudo-rapidity bin size, which is consistent with intermittent behaviour. The dependence on target

and on impact parameter are studied. The fluctuations are stronger for systems with fewer participating nucleons.

32707 (GSI–89-30(prepr.)) **Giant dipole resonances in hot nuclear matter in the model of self-relaxing mean-field.** Okolowicz, J.; Caurier, E.; Ploszajczak, M.; Drozdz, S. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Institute of Nuclear Physics, Cracow (Poland); Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires. Mar 1989. 21p. Order Number DE89774715/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Extended time-dependent Hartree-Fock approach is applied for the description of the isovector giant dipole resonance in /sup 40/Ca at finite temperatures. The thermalization process is described using the relaxation time ansatz for the collision integral. Strong inhibition of the giant dipole resonance γ decay is found due to the fast vaporization of the nuclear surface for thermal excitation energies above E/sup *//A≃4.5 MeV. This pre-equilibrium emission of particles in the vapour phase is associated with the isoscalar dipole expansion of nucleus and with the vanishing particle binding energies mainly for protons.

32708 (HMI-B–459, pp. 1-11) **Two-center effects in nucleon transfer between nuclei.** Oertzen, W. von (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.)). Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik; Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.); Freie Univ. Berlin (Germany, F.R.). Oct 1988. (CONF-880896–: JAERI international symposium on heavy-ion reaction dynamics in tandem energy region, Hitachi, Japan, 1-3 Aug 1988). In *Evolution of direct mechanisms with incident energy from the Coulomb-barrier to relativistic energies. - Two-center effects in nucleon transfer between nuclei. - Signatures of nucleon promotion in heavy ion reactions at barrier energies.* Available from NTIS (US Sales Only), PC A03/MF A01.

Starting with the system /sup 12/C+/sup 13/C as a model case, it is shown that a strongly coupled reaction scheme is established at energies close to the Coulomb barrier. The strongly coupled situation lends itself to an adiabatic picture of molecular orbitals and adiabatic energy potential curves. Consequences of such an adiabatic situation are discussed for nucleon transfer between heavy nuclei in particular proton transfer. Conditions equivalent to the situation in a Josephson junction can be created. The occurrence of a nuclear Stark effect is outlined.

32709 (HMI-B–459, pp. 1-5) **Signatures of nucleon promotion in heavy ion reactions at barrier energies.** Oertzen, W. von (Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.)); Voit, H.; Imanishi, B. Hahn-Meitner-Institut Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik; Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.); Freie Univ. Berlin (Germany, F.R.); Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Physikalisches Inst. Oct 1988. (CONF-880766–: 5. international conference on clustering aspects in nuclear and subnuclear systems, Kyoto, Japan, 25-29 Jul 1988). In *Evolution of direct mechanisms with incident energy from the Coulomb-barrier to relativistic energies. - Two-center effects in nucleon transfer between nuclei. - Signatures of nucleon promotion in heavy ion reactions at barrier energies.* Available from NTIS (US Sales Only), PC A03/MF A01.

Fast changes in shapes of angular distributions measured in small energy intervals close to the barrier are discussed as experimental evidence for nucleon promotion at avoided crossings of molecular orbital states (Landau-Zener Transitions). Three systems are illustrated (/sup 12/C+/sup 13/C, /sup 16/O+/sup 9/Be, /sup 13/C+/sup 14/C).

32710 (IC–88/375) **Production of light fragments in hA collisions at high energies.** Braun, M.A.; Vechernin, V.V. International Centre for Theoretical Physics, Trieste (Italy). Dec 1988. 11p. Order Number DE89612846/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Production of fast relativistic light fragments in hA collisions at high energies is considered. Direct coalescence of produced nucleons into fragments is shown to be the main mechanism for fragment production. The influence of the nuclear field is small and is not described by the well-known Butler-Pearson formulas. The coalescence coefficient strongly depends on the angle and on the behaviour of the fragment wave function at small internucleon distances. (author). 14 refs, 7 figs.

32711 (INDC(BZL)–030/LJ) **Multi-step direct multi-step compound description of fast particle induced reactions.** Carlson, B.V. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Feb 1989. 16p. Order Number DE89615775/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The results obtained in the development of computer codes to calculate one and two step continuum DWBA angular distributions and cross sections, level and transition strength densities and the development of an exciton-like model from the multi-step direct multi-step compound one are presented. 8 refs, 3 figs.

32712 (INDC(CCP)–292/L, pp. 5-9) **Incorporation of internal conversion coefficients into the ENSDF data sets.** Ignatochkin, A.E.; Potanina, T.D.; Shurshikov, E.N. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. In *Translation of selected papers published in Nuclear Constants 2, 1985.* Order Number DE89613030/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Original report in Russian was distributed as INDC(CCP)-248/G.

A program for automatic incorporation of internal conversion coefficients into the ENSDF data sets was developed. The program is based on modern computer calculations of these quantities. 3 tabs.

32713 (INDC(CCP)–293/L, pp. 33-48) **Level density and mean radiation widths of transactinides.** Antsipov, G.V.; Kon'shin, V.A.; Maslov, V.M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jan 1989. In *Translation of selected papers published in Nuclear Constants 3, 1985.* Order Number DE89613037/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Original report in Russian was distributed as INDC(CCP)-252/G.

The experimental data on neutron cross-sections for transactinides were analysed using a superfluid model which takes into account the collective modes. A level density parametrization was carried out for deformed axisymmetric nuclei in the mass number range 230-250, for which the rotational effects on the level density are significant. 9 figs.

32714 (INDC(CSR)–015/LJ) **Methods for the calculation of neutron induced reactions.** Gmuca, S.; Betak, E.; Antalik, R. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Feb 1989. 9p. Order Number DE89615776/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The results obtained in the improvement of the microscopic quasiparticle-phonon theory of direct continuum neutron inelastic scattering and the calculation of double-differential inelastic cross sections for 25.7 MeV neutrons on /sup 56/Fe, the optimization of the microscopic neutron optical potential calculation and the calculation of the neutron optical potential for /sup 54,56/Fe nuclei in the energy range 11-26 MeV, and the study of the neutron-gamma competition and the influence of nuclear structure on a preequilibrium gamma-emission are presented. 4 figs, 3 tabs.

32715 (INIS-mf–11429) **Study of spectroscopical properties of intermediate and heavy nuclei.** Stoica, S. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1988. 23p. (In Romanian). Order Number DE89615756/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

Spectroscopic properties of some even-even and even-odd nuclei belonging to the extreme vibrational and rotational zones are analyzed.

32716 (INIS-mf–11432) **Highly excited nuclei state and level densities.** Zimmer, K. W. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 22p. (In Romanian). Order Number DE89615757/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

The properties of the state densities on a large excitation energy spectrum are investigated.

32717 (INIS-mf–11433) **Competing mechanisms in helium ions induced fission. The role of shell effects.** Galeriu, D. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 22p. (In Romanian). Order Number DE89615814/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

Some theoretical and experimental aspects concerning the influence of the complex structure of the fission barrier in heavy nuclei reactions induced by charged particles are investigated.

32718 (INIS-mf–11434) **Investigation of the reaction mechanisms in /sup 19/F -medium-light nuclei systems.** Parlog, M. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 25p. (In Romanian). Order Number DE89615778/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

Heavy ion reactions for medium-light nuclei at low energies above the barrier are investigated. Complete information about F-19 + Co-89 are given.

32719 (INIS-mf–11436) **Interaction cross sections for multinucleonic processes in light nuclear systems.** Lazar, I. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 23p. (In Romanian). Order Number DE89615779/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

Some results of the multinucleonic processes in deep inelastic reactions for light systems are presented.

32720 (INIS-mf–11437) **Study of nuclear potentials used in heavy ions scattering.** Carstoiu, M.F.C. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 14p. (In Romanian). Order Number DE89615780/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

The heavy ion interaction potential is studied using the optical model.

32721 (INIS-mf–11439) **Contributions to the study of nuclei from the region Gd-146 excitation modes and interactions.** Trache, L.M. Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering. 1987. 24p. (In Romanian). Order Number DE89615782/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Published in summary form only.

The elementary excitation modes which are responsible for the low energy spectrum (E<3-4 MeV) and the interaction between these modes in atomic nuclei from the region Gd-146 are studied.

32722 (INIS-mf–11959) **Gross properties of nuclei and nuclear excitations. Proceedings.** Feldmeier, H. (ed.). Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik; Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.). 1986. 328p. (CONF-870154–: 15. international workshop on gross properties of nuclei and nuclear excitations, Hirschegg, Austria, 12-17 Jan 1987). Order Number DE89774794/JAW. Available from NTIS (US Sales Only), PC A15/MF A01.

These proceedings contain the invited and contributed papers presented at the named workshop. They deal with special topics in high- and intermediate-energy nuclear physics. Especially considered are the quark-gluon plasma, ultrarelativistic heavy ion reactions, and the application of QCD to nuclear structure calculations. (HSI).

32723 (INIS-SU–77/A, pp. 138-141) **On verification of t invariance in neutron reactions.** Bunakov, V.E. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Gudkov, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 1.* Available from NTIS (US Sales Only), PC A19/MF A01; INIS.

The possibilities of improving the upper limit for 'millistrong' interaction due to resonance enhancement of T-odd effects are discussed. T-noninvariant differences of total cross sections are investigated during polarized netron transmission through a polarized target. T-odd phase in neutron scattering on compound nuclei is of statistic nature. 9 refs.

32724 (INIS-SU–78, pp. 58-64) **On statistical theory of overlapping resonances.** Zelevinckij, V.G. (AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki); Sokolov, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

Instability of states removes level repulsion at the distance less than the width. The distribution function for complex energies and density of overlapped resonances are obtained for one channel case. The collective decay state is created with the large width. 11 refs.

32725 (INIS-SU–78, pp. 96-101) **Consistent systematics of energy-level density of nuclei in the range off $40 \leq A \leq 150$.** Grudzevich, O.T. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Ignatyuk, A.V.; Plyaskin, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 14-18 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The systematics of experimental data on density of neutron resonances and low-lying nuclear levels, taking into account the vibrational increase of the level density together with the influence of shell and superconductive effects, is considered. 12 refs.; 2 figs.

32726 (INIS-SU–78, pp. 13-25) **Role of pre-equilibrium theory in nuclear data evaluation.** Blann, M. (Lawrence Livermore National Lab., CA (USA)). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The utility of preequilibrium (PE) plus equilibrium decay models in reproducing neutron and γ-ray spectra for incident nucleons of 2-20 MeV is illustrated. Models and theories for calculating PE nucleon angular distributions and the short coming involved are discussed. Attention on special problem in modelling PE reactions for target nuclei near shell closures, and possible ways to improve the modelling in these regimes by use of shell model levels to generate few quasi-particle state densities. Preliminary tests of applicability of PE models to incident nucleon energies up to 1 GeV and for heavy ion induced reactions at energies up to 300 MeV are shown. 40 refs.; 16 figs.

32727 (INIS-SU–78, pp. 65-69) **Evaporation neutron spectra and nuclear level density.** Svirin, M.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Smirenkin, G.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The analysis of neutron spectra from (p,n) reaction with proton energies between 6 and 10 MeV based on the generalized superfluid nuclear model has been carried out. It is determined that the model parameters change abruptly in area of proton shell Z=50 and neutron number N=65. The question of an anomalous dependence of asymptotic level density parameter is far from being settled. 10 refs.; 2 figs.; 1 tab.

32728 (INIS-SU–78, pp. 70-75) **Description of neutron strength functions with allowance for multi-channel coupling.** Ignatyuk, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Lunev, V.P.; Pronyaev, V.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The neutron cross sections in the iron region are calculated in the frame of the multi-channel coupling method. Channels dominating in the formation of the optical potential imaginary part are taken into account. This approach allows to reach the consistent description of the s-, p- and d-neutron strength functions as well the total neutron cross sections at neutron energies up to 2 MeV. 13 refs.; 2 figs.; 1 tab.

32729 (INIS-SU–78, pp. 76-86) **Multistep processes in neutron-induced reactions.** Hodgson, P.E. (Oxford Univ. (UK). Dept. of Nuclear Physics). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 14-18 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The cross section of (n,n'), (n,p), (n,α), (n,2n) and other reactions of 10-20 MeV neutrons on a range of medium-weight and heavy nuclei have been calculated using the Weisskopf-Ewing and Feshbach-Kerman-Koonin theories. Detailed comparisons are made with the available experimental data. 20 refs.; 7 figs.; 1 tab.

32730 (INIS-SU–78, pp. 166-270) **New formulas for systematics of total radiative widths of neutron resonances.** Lomachenkov, I.A. (Joint Inst. for Nuclear Research, Dubna (USSR)); Furman, V.I. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 21 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

In the framework of the statistical approach with a phenomenological parametrization of the level density energy dependence the analytical formulae for total radiative widths of S-wave neutron resonances are obtained. 13 refs.; 1 fig.; 1 tab.

32731 (INIS-SU–78, pp. 257) **Application of the Reich-Moore formalism to description of interresonance interference in the α-decay channel of /sup 68/Zn and /sup 146/Nd compound nuclei.** Vtyurin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR)); Zhak, A.; Popov, Yu.P.; Ukraintsev, V.F. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 14-18 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

NEODYMIUM 146/alpha decay; ZINC 68/alpha decay; COMPOUND NUCLEI; DAUGHTER PRODUCTS; GROUND STATES; NEODYMIUM 145 TARGET; NEUTRON REACTIONS; PROBABILITY; REICH-MOORE FORMULA; ZINC 67 TARGET

32732 (IPNO-DRE–88-04) **Contribution of the final state interactions to the suppression of the J/PSI meson produced in high-energy nucleus-nucleus collisions.** Gerschel, C.; Hufner, J. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. Feb 1988. 9p. Order Number DE89776440/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

J/PSI mesons produced in 200 GeV/A Oxygen-Uranium collisions can be lost on their way out of the interaction zone by inelastic scattering with surrounding nucleons. We calculate this effect and find that it accounts for 25 % of the J/PSI suppression as observed by the NA 38 experiment.

32733 (ITP–87-148) **Lepton pair emission as a probe for space-time scenario of quark-hadron phase transition.** Bugaev, K.A.; Gorenstejn, M.I.; Pavlenko, O.P. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1987. 9p. Order Number DE89615786/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The correlation between lepton-pair thermal emission and hadronic multiplicity is explored to clear up the space-time picture of quark matter hadronization phase transition in ultrarelativistic nuclear collisions. 16 refs.; 1 fig.

32734 (ITP–88-2) **Study on the /sup 3/H + α and /sup 3/He + α elastic scatterings in a state with zero orbital moment.** Chopovskij, L.L. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki. 1988. 21p. Order Number DE89615787/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The asymptotics of the wave function of the relative motion of clusters is constructed at zero interaction energy. The set of equations of the resonating-group method (RGM) algebraic version is transformed to the zero energy limit of the relative motion of clusters. The equations obtained are used to calculate the /sup 3/H + α and /sup 3/He + α scattering lengths in the one-channel RGM approximation. The theory predicts large values of the scattering lengths for the elastic scattering of light charged clusters: ~10 + 23Fm for the /sup 3/H + α channel, and ~30 + 82Fm for the /sup 3/He + α channel. 19 refs.; 2 figs.; 2 tabs.

32735 (Juel-Spez–472) **Interactions between quasiparticles and phonons in odd-even nuclei in the region of /sup 88/Sr and /sup 90/Zr.** Unkelbach, W. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik. Oct 1988. 137p. (In German). Order Number DE89774615/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

Starting from a magic A-particle nucleus the neighbouring systems are investigated using the Green's functions method. For the A- and (A $\pm$ 2)-particle systems the well-known RPA equations are established, whereas for the (A $\pm$ 1)-particle systems one gets shift-equations, which describe the shift of the energies compared to the Hartree-Fock energies and the fracmentations of the single-particle strength between the quasiparticle states and states of more collective nature (quasiparticle x phonon). The mutual influence of the solutions of the RPA and the shift equations is discussed. Emphasis is put on the consistent inclusion of the particle-hole as well as the particle-particle RPA. As a concrete example the semi-magic nuclei /sup 88/Sr and /sup 90/Zr are considered. Calculations are performed with a Skyrme-III force. For the RPA and the shift calculations a Landau-Migdal force is used. The parameters are fixed from the consistency relations for nuclear matter and from comparison of the RPA results with empirical data. The shift calculations lead to an enhancement of the protonshell gap as compared to the Hartree-Fock calculations.

32736 (KIYI–88-18) **Processes of inelastic collision of composite particles with nonspherical nuclei.** Evlanov, M.V.; Isupov, V.Yu.; Tartakovskij, V.K. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 17p. (In Russian). Order Number DE89615788/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The processes of diffraction dissociation of cluster nuclei by non-axial deformed even-even nuclei are investigated taking the nuclear edge diffuseness into consideration. Inelastic scattering of deuterons and alpha particles with the excitation of low-lying rotational energy level with the spin and parity 2/sup +/is considered as well. In the obtained formulas and performed calculations the effect of double scattering is taking into account; no assumption is made

on incident particle size being small as compared to that of nucleus. 17 refs.; 6 figs.

32737 (LA-UR–89-1747) **Theory of neutron emission in fission.** Madland, D.G. Los Alamos National Lab., NM (USA). 1989. 8p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890406–20: Fifty years with nuclear fission conference, Gaithersburg, Maryland, USA, 25-28 Apr 1989). Order Number DE89013435/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Following a summary of the observables in neutron emission in fission, a brief history is given of theoretical representations of the prompt fission neutron spectrum N(E) and average prompt neutron multiplicity $\bar{\nu}_p$. This is followed by descriptions, together with examples, of modern approaches to the calculation of these quantities including recent advancements. Emphasis will be placed upon the predictability and accuracy of the modern approaches. In particular, the dependence of N(E) and $\bar{\nu}_p$ on the fissioning nucleus and its excitation energy will be discussed, as will the effects of and competition between first-, second- and third-chance fission in circumstances of high excitation energy. Finally, properties of neutron-rich (fission-fragment) nuclei are discussed that must be better known to calculate N(E) and $\bar{\nu}_p$ with higher accuracy than is currently possible. 17 refs., 11 figs.

32738 (LA-UR–89-1748) **Our 50-year odyssey with fission: Summary.** Nix, J.R. Los Alamos National Lab., NM (USA). 1989. 21p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890491–7: International conference on fifty years of research in nuclear fission, Berlin, Germany, F.R., 3-7 Apr 1989). Order Number DE89012733/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

On the occasion of this International Conference on Fifty Years Research in Nuclear Fission, we summarize our present understanding of the fission process and the challenges that lie ahead. The basic properties of fission arise from a delicate competition between disruptive Coulomb forces, cohesive nuclear forces, and fluctuating shell and pairing forces. These static forces are primarily responsible for such experimental phenomena as deformed ground-state nuclear shapes, fission into fragments of unequal size, sawtooth neutron yields, spontaneously fissioning isomers, broad resonances and narrow intermediate structure in fission cross sections, and cluster radioactivity. However, inertial and dissipative forces also play decisive roles in the dynamical evolution of a fissioning nucleus. The energy dissipated between the saddle and scission points is small for low initial excitation energy at the saddle point and increases with increasing excitation energy. At moderate excitation energies, the dissipation of collective energy into internal single-particle excitation energy proceeds largely through the interaction of nucleons with the mean field and with each other in the vicinity of the nuclear surface, as well as through the transfer of nucleons between the two portions of the evolving dumbell-like system. These unique dissipation mechanisms arise from the Pauli exclusion principle for fermions and the details of the nucleon-nucleon interaction, which make the mean free path of a nucleon near the Fermi surface at low excitation energy longer than the nuclear radius. With its inverse process of heavy-ion fusion reactions, fission continues to yield surprises in the study of large-amplitude collective nuclear motion. 87 refs., 12 figs.

32739 (LBL–27093) **Spontaneous fission of the heaviest elements.** Hoffman, D.C. Lawrence Berkeley Lab., CA (USA). Apr 1989. 9p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8904201–3: American Nuclear Society meeting, Gaithersburg, Maryland, USA, 25-28 Apr 1989). Order Number DE89013421/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Although spontaneous fission was discovered in ^{238}U in 1940, detailed studies of the process were first made possible in the 1960's with the availability of milligram quantities of ^{252}Cf. The advent of solid-state detectors made it possible to perform measurements of coincident fission fragments from even very short-lived spontaneous fission activities or those available in only very small quantities. Until 1971 it was believed that the main features of the mass and kinetic-energy distributions were essentially the same as those for thermal neutron-induced fission and that all low-energy fission proceeded via asymmetric mass division with total kinetic energies which could be derived by linear extrapolation from those of lighter elements. In 1971, measurements of ^{257}Fm showed an increase in symmetric mass division with anomalously high TKE's. Subsequent experiments showed that in ^{258}Fm and ^{259}Fm, the most probable mass split was symmetric with very high total kinetic energy. Measurements for the heavier elements have shown symmetric mass distributions with both high and low total kinetic energies. Recent results for spontaneous fission properties of the heaviest elements are reviewed and compared with theory. 31 refs., 8 figs., 1 tab.

32740 (UCRL–100998) **Photon annd pion production in heavy ion collisions.** Blann, M. Lawrence Livermore National Lab., CA (USA). May 1989. 12p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-8905143–1: NATO international advanced courses on the nuclear equation of state, Peniscola, Spain, 12 May - 3 jun 1989). Order Number DE89012298/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper we describe different formulations for treating the nucleon-nucleon transport physics. These will all be semi-classical treatments; however considerable work has been done considering the relationship between quantal and semi-classical formulations. We discuss additional input specific to calculation of pion and photon yields, and present comparisons between calculated and experimental results, mostly for high energy photons. Conclusions and suggestions for future work are presented in the last section. 65 refs., 7 figs.

32741 **Effective Lagrangian approach to K^+-nucleon scattering and K^+ photoproduction.** Cohen, J. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)). *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2285-2294 (Jun 1989).

We study K^+N low-energy scattering using the effective Lagrangian approach. The scattering mechanism model consists of hyperon and meson exchanges (this model is borrowed from π-N scattering calculations). We limit ourselves to the tree level, motivated by nuclear physics applications. Canonical values of the required coupling constants give rise to scattering parameters which disagree strongly with experiment. Kaon photoproduction ($\gamma+p\rightarrow K^++\Lambda$) studies using a similar model also yield coupling constants which differ from standard compilations values. Using these values in the K^+N scattering calculations, we find a better agreement with experiment (the level of agreement is still only within a factor of 2–3, however). We discuss the role of ω and ρ t-channel mesonic exchanges in the scattering process and elaborate on the implications to some recent work in the current literature. Possible reasons for the results and discrepancies found in the present work, as well as possible implications, are discussed.

32742 **Mechanisms for spin suppression and orbital enhancement in $M1$ transitions: Critical assessment.** Zamick, L. (Department of Physics and Astronomy, Rutgers University, Piscataway, New Jersey 08855(US)); Zheng, D. C.; de Guerra, E. M. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2370-2378 (Jun 1989).

We discuss different nuclear structure properties that may lead to spin suppression in magnetic dipole excitations (as well as in Gamow-Teller transitions). We especially compare the triaxial and the axial asymptotic deformation limits and show that the summed $B(M1)$ strength can be quite different in the two cases. A connection between triaxial deformation and spin suppression is established. It is known, however, that modern Hartree-Fock calculations yield axially symmetric solutions for several nuclei which were previously thought to be triaxial. We show that taking into account the effects of higher shells can lead to an enhanced *orbital* contribution to $M1$ excitations without affecting ground-state magnetic moments.

32743 **Random phase approximation studies in the fermion dynamical symmetry model: SO(8).** Wenes, G. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Ginocchio, J. N. *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2426-2437 (Jun 1989).

The SO(8) dynamical symmetry limit of the Fermion dynamical symmetry model is used to study various aspects of the quasiparticle random phase approximation. The zero frequency modes of the

general quasiparticle random phase approximation are given in analytical form. The quasiparticle random phase approximation excitation energy and transition probability are derived in analytical form in the spherical limit of the general SO(8) Hamiltonian.

32744 Coupling constants in kaon photoproduction. Workman, R. L. (Department of Physics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061(US)). *Physical Review [Section] C: Nuclear Physics (USA),* 39(6): 2456-2457 (Jun 1989).

A fit to kaon photoproduction data has been made within the diagrammatic approach. We demonstrate the need to calculate error bounds on the coupling constants derived from least-squares analyses if these couplings are to be compared to those determined in analyses of $K^{\pm}N$ data.

32745 Baryon production in the central region of ultrarelativistic heavy-ion collisions. Werner, K. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973(US)). *Physical Review Letters (USA),* 62(21): 2460-2463 (22 May 1989). DOE Contract AC02-76CH00016.

We introduce a new string model (venus 2) for ultrarelativistic heavy-ion collisions, based on color exchange between quarks and also between antiquarks. These two mechanisms affect the rapidity distribution of baryons differently: Quark color exchange shifts baryons towards central rapidity, antiquark color exchange moves baryons back towards large (c.m.) rapidities. We obtain almost flat baryon rapidity distributions for symmetric *A+A* collisions. Rapidity distributions for proton-nucleus collisions show a forward plateau rather than a forward peak, in agreement with data.

6540 Radiation and Shielding Physics

Refer also to citation(s) 31173, 32798, 33028, 33029

32746 (AD-A–204202/6/XAB) **Radiation dose in a Molniya-type orbit. Technical report.** Blake, J.B.; Cox, J.E. Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab. 1 Dec 1988. 13p. (TR–0088(3940-05)-4). Available from NTIS, PC A03/MF A01.

A pair of dosimeters aboard satellites in Molniya orbit made measurements of the radiation dose under 0.69 gm/sq.cm of aluminum. The measured dose was substantially less than that predicted by the NASA AE-8 and AP-8 models. The cause of the difference cannot be determined with certainty. One possibility is tha AP-8 is in agreement with the observations and that AE-8 leads to a substantial overestimate of the dose due to electrons.

32747 (BARC–1427) **Importance biasing for 1-D deep-penetration problem by Monte Carlo.** Gupta, H.C.; Dwivedi, S.R. Bhabha Atomic Research Centre, Bombay (India). 1988. 90p. Order Number DE89612741/JAW. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Using the integral equations for the first and second moments of the 'total score' in an analogue and non-analogue simulations zero-variance biasing schemes have been obtained for all the commonly used reaction rate estimators. For partial score estimators a new zero-variance biasing scheme has been obtained as a special case. The new zero-variance scheme developed for partial score estimators has been used to develop an importance biasing scheme for use with expectation estimator in one dimensional deep-penetration problems with isotropic scattering. The importance biasing scheme has been studied for variance reduction in shields with anisotropic scattering. It is observed that the scheme not only results into a significant reduction in variance over the exponential biasing but also simplifies the complicated sampling procedure for the particle's outgoing direction at collision point. (author). 27 tables, 79 refs.

32748 (INIS-BR–1505) **SAXS study of silica sols, gels and glasses obtained by the sol gel process.** Santos, D.I. dos; Aegerter, M.A.; Craievich, A.F. Associacao Brasileira de Ceramica, Sao Paulo, SP (Brazil). 1988. 17p. (In Portuguese). (CONF-8804217–: 32. Brazilian congress on ceramics, Natal, Brazil, 24-27 Apr 1988). Order Number DE89612754/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Systematic SAXS studies have been performed at the LURE Synchrotron, Orsay, using an intense beam of point like cross-section to obtain information about the sol -> humid gel -> dried gel -> silica glass transformation. The intensity curves have been analysed in term of power law in log-log plots, whose exponent is related to mass and surface fractal dimensions of the structure. It was found that almost all phases present fractal structures and for the case of basic gels, is of hierarchical nature. The aerogels are formed by a dense matrix, with a smooth surface and exhibit a very narrow autosimilarity range that gives a mass fractal dimension.

32749 (INIS-SU–78, pp. 184-189) **Effect of thermal neutron acceleration by vibrationally-excited nitrogen molecules.** Laptev, A.B. (AN SSSR, Leningrad (USSR). Inst. Yadernoj Fiziki); Petrov, G.A.; Pleva, Yu.S.; Yamshchikov, M.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); AN SSSR, Moscow (USSR); AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). (CONF-870959–: 1. international conference on neutron physics, Kiev, USSR, 14-18 Sep 1987). In *Neutron physics. Vol. 2.* Order Number DE89012115/JAW. Available from NTIS (US Sales Only), PC A16/MF A01; INIS.

The effect of neutrons inelastic scattering ("acceleration") with discrete energy transfer from N/sub 2/molecules vibrationally excited in glow discharge is observed experimentally. The ratio of acceleration cross section to that of elastic scattering turned out to be laid in the limits of (6-14)% and to be in agreement with theoretical predictions. 4 refs.; 3 figs.

32750 (OEVS-Mitteilung–1988, pp. 434-439) **Back scattering coefficients for 50 to 400 kV X-rays scattered on baryt concrete.** Markovic, P. (Kragujevac Univ. (Yugoslavia). Inst. za Fiziku); Ristic, D.; Vukovic, S. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Using a special experimental arrangement and procedure, developed in our laboratory, the back scattering coefficients for 50 to 400 kV X-rays scattered on baryt concrete were measured. The experimental arrangement and procedure were such that they met the IEC recommendations for these measurements. 3 refs., 4 figs.

32751 (OEVS-Mitteilung–1988, pp. 621-624) **Measurement of fast neutron spectra from iron shielded americium-beryllium source.** Nikolic, D. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)); Milosevic, M.; Pesic, M. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The measurements were carried out using the zero-crossing technique of pulse-shape discrimination system to distinguish neutron from gamma-ray pulses. The neutron spectra have been evaluated from measured pulse-height distribution using computer code based on an unfolding method. Results obtained in measurements are compared to the results of fast neutron shielding calculations estimated by PMK computer code. The subgroup approximation and Monte Carlo method were applied in calculations. A brief survey of results and a discussion are presented. 7 refs., 3 figs., 1 tab.

32752 (RAL–89-004) **High energy magnetic inelastic neutron scattering at ISIS.** Osborn, R. Rutherford Appleton Lab., Chilton (UK). Jan 1989. 31p. Order Number DE89612747/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Two recent experiments on the HET spectrometer of the U.K. spallation neutron source ISIS are described, as examples of the potential of high energy magnetic neutron scattering. The measurements of intermultiplet transitions with energies up to 810 meV in praseodymium metal give direct evidence of the screening of the intra-4f electrostatic interaction for the first time in a metal. Crystal field splittings in the UO/sub 2/establish both the symmetry of the

ordered phase and the degree of J-mixing in the ground state wavefunctions.

32753 (RAL–89-013) **Anisotropy and energy dependence of the differential neutron scattering cross-section in vanadium.** Mayers, J. Rutherford Appleton Lab., Chilton (UK). Feb 1989. 16p. Order Number DE89615743/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Time of flight spectra produced by scattering from vanadium have been collected at angles of 53/sup 0/and 153/sup 0/. The ratio of these spectra exhibits significant anisotropy and energy dependence of the differential cross-section. This behaviour is attributed to inelastic scattering. A theoretical calculation using the harmonic approximation gives good agreement with the data but appears to slightly underestimate these effects. Some implications for the use of vanadium as a calibration sample for neutron spectrometers are discussed.

32754 (UCRL–99499) **Criticality benchmarks for COG: A new point-wise Monte Carlo code.** Alesso, H.P.; Pearson, J.; Choi, Jor Shan. Lawrence Livermore National Lab., CA (USA). May 1989. 10p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890631–7: International symposium on packaging and transporting of radioactive materials, Washington, D.C., USA, 11-16 Jun 1989). Order Number DE89011897/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

COG is a new point-wise Monte Carlo code being developed and tested at LLNL for the Cray computer. It solves the Boltzmann equation for the transport of neutrons, photons, and (in future versions) charged particles. Techniques included in the code for modifying the random walk of particles make COG most suitable for solving deep-penetration (shielding) problems. However, its point-wise cross-sections also make it effective for a wide variety of criticality problems. The objective of this paper is to present calculational results of a variety of critical benchmark experiments using COG, and to present the resulting code bias. Numerous benchmark calculations have been completed for a wide variety of critical experiments which generally involve both simple and complex physical problems. The COG results, which we report in this paper, have been excellent.

32755 Electron degradation and yields of initial products: V. Degradation spectra, the ionization yield, and the Fano factor for argon under electron irradiation. Kowari, K. (Argonne National Laboratory, Argonne, Illinois 60439(US)); Kimura, M.; Inokuti, M. *Physical Review [Section] A: General Physics (USA)*, 39(11): 5545-5553 (1 Jun 1989). DOE Contract W-31-109-ENG-38.

The electron-degradation spectrum is fundamental for describing a variety of quantities bearing on electron slowing-down processes in matter. We calculate the electron-degradation spectrum in Ar gas by solving the Spencer-Fano equation, using a realistic set of cross sections. The influence of Auger electrons on the degradation spectrum is studied in detail. As an application, we study the statistical fluctuations in the ionization yield, which are expressed in terms of the Fano factor $F(T)$ for an electron incident at fixed energy T. The energy dependence of $F(T)$ is greatly influenced by L-shell ionization. The Fano factor approaches an asymptotic value of 0.16 at T=2 keV. Our results are consistent with experimental results.

6550 Medical Physics

Refer also to citation(s) 32936, 32938, 32950

32756 (CCHEN–1) **Environmental radioactivity in Chile - during 1987 - Technical information.** Alegria R, E.; Albornoz G, M.P.; Landabur P, J. Comision Chilena de Energia Nuclear, Santiago (Chile). Aug 1988. 62p. (In Spanish). Order Number DE89616685/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Individual results of fallout radiactive analysis from 500 samples of: drink water, rain water, milk, sediment dust, C.R.A.P.A.L. filters and air filters, obtained during 1987 in 10 sampling sites distribuited between 18 to 54 degrees South Latitude, within Chilean's territory, is presented in this report. The principals radionuclides analized were Sr-89, Sr-90 and Cs-137. The concentrations of these were nearly at the lower limits of detection of the analytical systems that we used currently to measure them. (1 figure, 27 tables, 10 references). (author) (one map).

32757 (CNEN-NE–5-03) **Transport, acceptance, storage and handling of the itens of nuclear power plants.** Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). 1989. 39p. (In Portuguese). Order Number DE89616630/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The norm aiming to establish the requirements applied to workers or organizations which participate of the activities of transport, acceptance, storage and handling of important itens for safety of nuclear power plants, is presented. The established requirements treat of protection and control necessary to assure that the quality of important itens for safety be it preserved from the end of fabrication until their incorporation to nuclear power plant. (M.C.K.).

32758 (IAEA-R–4535/F) **Estimation of DNA synthesis in lymphocyte as biological indicator in radiation accidents. Final report for the period 1 November 1986 - 30 November 1988.** Wei Kang. International Atomic Energy Agency, Vienna (Austria). Dec 1988. 8p. Order Number DE89616686/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The IAEA-supported research contract 4535 entitled "Estimation of DNA synthesis in lymphocyte as biological indicator in radiation accidents" has been successfully carried out by the investigators at the Institute of Radiation Medicine in Beijing, People's Republic of China. A new potential trend has been fostered and enhanced through the reported work to add to the growing spectra of quantitative biological dosimetry systems for absorbed radiation exposure monitoring in aid of radiation protection services. The current topic deals with assay system based on the body's intrinsic repair capacity for radiation-induced genetic (DNA) lesions. Unscheduled DNA synthesis (UDS) induced by ultraviolet light has been calibrated and quantitated in vitro to measure cellular repair capacity. Dose-dependent detriments of this repair capacity in both lymph nodes and peripheral blood lymphocytes following whole- and part-body exposure(s) to /sup 60/Co-gamma radiation have been estimated using current techniques of molecular radiation cytogenetics and relevant analytical methods. Lymphocyte transformation assay to determine the quantitative effects of radiation exposure doses has also been attempted and some preliminary data have been reported. The method, however, is at present of somewhat lesser precision but holds promises for the future. 4 refs, 1 fig., 7 tabs.

32759 (INIS-mf–11404 S26) **Studies on lens and gonad radiation doses in computerized tomography.** Rosenkranz, G. (Medizinische Akademie, Dresden (German Democratic Republic). Radiologische Klinik); Tellkamp, H.; Berndt, L.; Standertskjoeld-Nordenstam, C.G. Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite). 1988. (In German). (CONF-8810355–: Charite-symposium 'CT and MR in medicine', Berlin, German Democratic Republic, 17-18 Oct 1988). In *Abstracts of the Charite-symposium 'CT and MR in medicine'.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

COMPUTERIZED TOMOGRAPHY/radiation doses; ABDOMEN; CRYSTALLINE LENS; GONADS; PELVIS; SKULL

32760 (INIS-mf–11406, pp. 40) **Dosimetry of space radiation and radiation problems in manned space flight.** Buecker, H. (DFVLR Inst. for Aerospace Medicine, Koeln (Germany, F.R.). Div. of Biophysics); Facius, R.; Reitz, G. European Society for Radiation Biology, Liege (Belgium). 1988. (CONF-8810353–: 21. annual meeting of the European Society for Radiation Biology, Tel-Aviv, Israel, 24-30 Oct 1988). In *European Society for Radiation Biology 21. annual meeting. Program and abstracts.* Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

DOSIMETRY/space flight; SPACE FLIGHT/radiation hazards; COSMIC RADIATION; DOSIMETRY; RADIATION PROTECTION; STANDARDIZATION

32761 (INIS-SU–81/A, pp. 15-22) **Standardization of x-ray diagnostic irradiation on the basis of control level system.** Nikitin, V.V. Nauchno-Issledovatel'skij Inst. Radiatsionnoj Gigieny, Leningrad (USSR). 1988. (In Russian). In *Actual problems of radiation safety in medicine. Results and prospects. Collection of*

scientific papers. Order Number DE89780089/JAW. Available from NTIS (US Sales Only), PC A05/MF A01; INIS.

The problems and methodology of irradiation standardization of patients in radiodiagnosis are considered. A system of control levels limiting radiation doses in certain examinations is proposed and substantiated as a basis standardization element. Numerical values for most widely used x-ray examinations are determined. A possibility of practical realization of the given standardization system is shown, and the prospects in population irradiation decrease in medical examinations are considered in medical examinations are considered. 11 refs.; 1 tab.

32762 (KIYI–88-1, pp. 3-13) **Clinical dosimetry at remote neutron therapy irradiation in Kiev U-120 cyclotron.** Isaenko, V.I.; Koval', G.N.; Nikishin, B.K.; Svarichevskaya, E.V.; Chernichenko, V.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). In *Dosimetric plan of distance irradiation.* Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

The dosimetric planning and control of radiation burdens as a result of neutron therapy using the medico-biological complex of UkSSR AS INR the direct measurements of dose distributions in tissue-equivalent (TE) phantom of man (Alderson Rando-phantom) are measured. The dose distributions obtained testify to dosimetric substantiation of the use of 6 MeV fast neutron beam for the treatment of patients with tumors of certain localizations both independently and in combination with quantum radiation. 2 refs.; 5 figs.

32763 (KIYI–88-2, pp. 3-16) **Dose rate and spectral parameters investigation of fast neutron beams in medico-biological complex of Kiev U-120 cyclotron.** Koval', G.N.; Isaenko, V.I.; Staricheskaya, E.V.; Gul'ko, G.M.; Bukanov, V.N.; Kolotyj, V.V.; Vasil'eva, E.G.; Maslyaev, P.F.; Shevel', V.N. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. (In Russian). In *Medico-biological complex of Kiev cyclotron U-120 (MBC U-120).* Order Number DE89780086/JAW. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Investigation results of dosimetric and spectral characteristics of a fast neutron beam produced by the U-120 cyclotron and designed for remote irradiation of oncologic patients are presented. 5 refs.; 8 figs.

32764 (OEVS-Mitteilung–1988, pp. 1-9) **Highlights in the evolution of radiation protection practices.** Eisenbud, M. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

A historical review of the development of radiation protection standards and limits, from Roentgen's discovery of X-rays to the present days. (qui).

32765 (OEVS-Mitteilung–1988, pp. 73-76) **Standardization in radiation protection.** Buchner, I. (Oesterreichisches Normungsinstitut (ON), Vienna (Austria)); Tschirf, E. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The engineering standard committee of Austria comprises the working groups: terminology;radiation protection equipment;radioactive materials;radiation ranges;dosimetry;radioactive wastes;radioactivity in building materials; low-level measurements. The Austrian standards worked out by the groups are listed. (qui).

32766 (OEVS-Mitteilung–1988, pp. 158-161) **Kerma rates and whole-body absorbed dose rates for immersion in a semi-infinite cloud.** Le Grand, J. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire); Roux, Y. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Kerma rates and whole-body absorbed dose rate are calculated above various soils with computer codes using Monte Carlo techniques. 6 refs., 8 figs., 1 tab.

32767 (OEVS-Mitteilung–1988, pp. 167-171) **Calculation on free-in-air kermas and effective dose equivalents from radioisotopes deposited on soil.** Koblinger, L. (Central Research Institute for Physics, Budapest (Hungary)); Nagy, G. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Free-in-air fluxes, kermas and effective dose equivalents in anthropomorphic phantoms as source energies are calculated by an adjoint Monte Carlo code for gamma emitters in the soil. Fluxes and kermas are given for various heights above the ground. 5 refs., 4 figs., 5 tabs.

32768 (OEVS-Mitteilung–1988, pp. 348-364) **Critical comments on the current system of radiation protection and suggestions for improvement.** Katoh, K. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Personal impressions are given on the current system of radiation protection, whose development of course owes much to the ICRP and ICRU. They have functioned satisfactorily and activities of these two international commissions are to be highly praised, but it seems that there still is some room left for improvement. Systemization of dosimetry and of dose limitation are discussed and suggestions are given to strengthen the foundation of the system. Unifying the doses for protection and defining the limitation system with this single dose in a unified way are proposed. 2 refs., 2 tabs.

32769 (OEVS-Mitteilung–1988, pp. 375-390) **Choice of treshold values triggering the decontamination procedure in nuclear plants working places.** Charuau, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)); Ammerich, M.; Zettwoog, P. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Working places in nuclear plants are often progressively contaminated. Taking into account the disadvantages of the contamination, the operating company may be led to undertake a decontaminating procedure. This note is aimed at helping the company to trigger judiciously the moment of such a procedure, and particularly to give the threshold value of the surfacic activity, which should not be exceeded in the different circumstances and for the different radionuclides. Whatever the procedure to determine the triggering threshold value, it will require a good knowledge of the mechanisms of resuspension and transfer between contaminated surfaces and workers. An abstract of the data available in literature, and the results of the current researches in our laboratories are given. 7 refs., 5 figs., 2 tabs.

32770 (OEVS-Mitteilung–1988, pp. 465-469) **Long-term experience in mixed field radiation monitoring.** Goebel, K. (European Organization for Nuclear Research, Geneva (Switzerland)); Hoefert, M. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

The experience of measurement techniques is described, covering nearly thirty years of radiation monitoring in mixed radiation fields around the CERN high energy proton accelerators. Because of the exceptional character of these fields it became necessary to develop special measurement techniques both in area and individual dosimetry. While these methods exist, which allow estimates to be made of effective dose equivalent, they have to be considered in view of the new ICRU quantities. 13 refs.

32771 (OEVS-Mitteilung–1988, pp. 440-443) **Dose assessment and medical consequences of radiation exposure of employees of Electricite de France.** Bertin, M. (Electricite de France, 75 - Paris (France). Comite de Radioprotection); Lallemand, J.; Berthet, J.P. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

It is pointed out that radiation protection is both for physicians and engineers, and that information gained from personnel dosimetry should be used to modify the design of equipment, to eliminate or reduce causes of radiation exposure. The field of experience in question are nuclear power plants operated by Electricite de France. 10 refs. (qui).

32772 (OEVS-Mitteilung–1988, pp. 554-557) **Quo vadis, personnel monitoring?.** Becker, K. (DIN Deutsches Inst. fuer Normung e.V., Berlin (Germany, F.R.)). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Comparative advantages and disadvantages of film, TLD and solid-state dosemeters are discussed, and some recommendations on improvements are presented. The so called biological dosimetry is considered to be more of a research tool than a practical alternative to the physical dosimetry. 18 refs. (qui).

32773 (OEVS-Mitteilung–1988, pp. 558-562) **Operation experience with an automatic dosimetry system and digitally indicating dosemeters in the Gundremmingen nuclear power plant block B and C.** Bergemann, L. (Kernkraftwerk RWE-Bayernwerk G.m.b.H., Gundremmingen/Guenzburg (Germany, F.R.)); Poeschl, A.; Kirsch, H. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Experience has shown that in a nuclear power plant a quick and reliable radiation monitoring for personnel and work orders can be achieved only by an automatic dosimetry system with electronically readable dosemeters and computer support. This is true in particular during inspection work, with a high number of personnel in the control area. In the Gundremmingen power plant, blocks B and C have a common access to the control area. 1100 digital dosimeters (ALNOR RAD 80) with 18 automatic reading stations and a dosimetry computer VAX 780 are used. The requirements on the system are defined, the functions of the components are outlined and operational experience with the system since 1984 is reported. 2 refs., 2 figs.

32774 (OEVS-Mitteilung–1988, pp. 635-639) **On the importance of probability distributions of parameters in dose assessments.** Tschurlovits, M. (Atominstitut der Oesterreichischen Universitaeten, Vienna (Austria)); Hofmann, W. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Experimental data to be used in dose assessments, such as environmental parameters, dose rate, activity intake and other related quantities are usually randomly distributed. General information on their probability distributions can be obtained from a sufficiently large number of experimental data. This information can then be used to predict the shape of such distributions. 9 refs., 6 figs.

32775 (OEVS-Mitteilung–1988, pp. 640-644) **Personal doses from beta radiation in Swiss nuclear power plants.** Pfeiffer, H.J. (Hauptabteilung fuer die Sicherheit der Kernanlagen, Wuerlingen (Switzerland)); Valley, J.F. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (In German). (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Following a suggestion of the main depart for nuclear power plant's safety, possible personal doses from beta radiation have been measured during the summer shutdown 1983 and 1984 in two Swiss nuclear power plants (BWR and PWR) by the institut de radiophysique appliquee Lausanne. It turned out that in average these doses are negligible. The possible beta contribution to the dose at the dosimeters is less than 20% even under conservative assumptions. Since this is a skin dose where the maximum permissible year dose is six times higher than that for the whole-body radiation the contribution to the equivalent whole-body dose is 3-4% which again is negligible. 4 tabs.

32776 (OEVS-Mitteilung–1988, pp. 704-707) **Regulations in the Federal Republic of Germany to ensure a satisfactory quality of radiation protection dosemeters.** Kramer, H.M. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)); Hohlfeld, K. Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

For all dosimeters it is essential that they are reliable and sufficiently accurate. The Physikalisch-Technische Bundesanstalt (a federal bureau of standards) of the Federal Republic of Germany evaluates and approves types of indirect - and direct reading dosemeters. Tests include several 'influence quantities' such as photon energy, direction of incident radiation, dose rate, supply voltage, temperature, atmospheric pressure and relative humidity. Their nominal range, reference value and deviation has to be specified and this is done depending on the intended use. It is estimated that in field use where the influence quantities vary over the allowed ranges, the deviation of dose readings will be about ±50%. 6 refs., 1 tab. (qui).

32777 (SAAS–367) **Calibration and intercomparison of neutron moderation spectrometers.** Rimpler, A.; Hermanska, J.; Prouza, Z. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 35p. Order Number

DE89616948/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Results have been reported of comparative measurements of neutron fields from bare PuBe and Cf sources using multisphere (Bonner) spectrometers. The experiments were carried out by the Institute of Biophysics and Nuclear Medicine at Charles University in Prague and the National Board for Atomic Safety and Radiation Protection in Berlin. Both sides agreed upon uniform measuring conditions and calibration factors thus rendering possible the comparability of the dosimetric parameters which have been determined and verified, respectively, to an accuracy of ± 10%. 20 refs., 10 tabs., 2 figs.

32778 (SAAS–370) **External occupational radiation exposure in the GDR in 1987.** Rothe, W. Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic). 1989. 20p. (In German). Order Number DE89616705/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In 1987, a total of 37145 radiation workers were monitored by the film badge service of the National Board of Atomic Safety and Radiation Protection. None of the external gamma- or X-ray doses were found to exceed the secondary limit of 50 mSv in a year with 97.8% of them remaining below 1/10 of this value. 105 workers received doses from electrons which did not exceed 3/10 of the secondary limit of 500 mSv/year for the maximum surface dose. Additional data obtained by monitoring 1161 radiation workers with finger-ring dosemeters demonstrated that hand exposures in no case exceeded the secondary limit of 500 mSv/year. The annual dose data have been presented in tabular form by dose range, type of establishment, and field of application. Also given were annual collective doses, annual average doses and special collective dose quotients for workers in important fields of application of ionizing radiation. 10 tabs.

32779 (SNV–3399) **Radioecologic control of the surroundings of the Ringhals nuclear power station up to and incl. 1986.** Notter, M. National Swedish Environmental Protection Board, Solna (Sweden). 1987. 71p. (In Swedish). Order Number DE89613901/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

For the surrounding of each Swedish nuclear power station there is a control program concerning radionuclides. Every year samples are taken from algeas, mussels, fish, moss, lichen, crops, lettuce, milk and eattle. This report is a summary of this control for Ringhals up to 1986. Discharge of radioactivity from Ringhals nuclear power station is of limited extent. Only in the immediate surroundings registrable percentages of radio nuclides are established concerning terrestrial as well as marin environment. The radioactive nuclides (C-14 excluded) which up to 1986 have been discharged from the power station are less than 1% of the dose caused by background activity (cosmic radiation and natural radioactivity) and fallouts from nuclear bomb tests. (L.F.).

32780 (SSI–88-20) **Nuclear power industry: Activity emissions, occupational exposures.** National Inst. of Radiation Protection, Stockholm (Sweden). 19 Sep 1988. 40p. (In Swedish). Order Number DE89613904/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A compilation of radioactive emissions and personnel doses at nuclear facilities in Sweden oct-dec 1987, and cumulated values for 1987. (L.E.).

6560 Condensed Matter Physics

Refer also to citation(s) 31173, 31251, 31469, 31679, 32506

32781 (ACIESP–60(v.3), pp. 377-386) **Experimental studies on the surface confined quiescent plasma at INPE.** Ferreira, J.L. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Ferreira, J.G.; Sandonato, G.M.; Alves, M.V.; Ludwig, G.O.; Montes, A. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

The quiescent plasma machines used in several experiments at the Associated Plasma Laboratory in INPE are presented. The research activities comprise particle simulation studies on ion acoustic double layers, and studies on the plasma production and loss in surface confined magnetic multidipole thermionic discharges. Recent results from these studies have shown a non-maxwellian plasma formed in most of the discharge conditions. The plasma leakage through the multidipole fields shows an anomalous diffusion process driven by ion acoustic turbulence in the magnetic sheath. The information derived from these studies are being used in the construction and characterization of ion sources for shallow ion implantation in semiconductors, in ion thruster for space propulsion and in the development of powerful ion sources for future use in neutral beam injection systems.

32782 (AERE-M–3679) **Operating instructions for the collection and analysis of x-ray diffraction data using a position sensitive detector system.** Jones, A.M. UKAEA Harwell Lab. (UK). Materials Development Div. Sep 1988. 61p. Available from H.M. Stationery Office, London, price Pound 10.00.

Instructions are given on how to set up and use a position sensitive detector (PSD) system both manually and automatically. A set of three computer programs written in PASCAL on an IBM PC AT are described - for collection, display and analysis of data using the PSD. Some examples of data collected are shown to illustrate the advantages over a conventional detection facility.

32783 (ANU-P–1002) **Comment on X-ray production by Pt and Os projectiles moving in thick Fe Targets with E/sub p/= 17.30 MeV.** Stuchbery, A.E. Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics. Mar 1988. 4p. Order Number DE89615449/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In a recent paper, Pakou et al. concluded that if the transient field for PtFe is weaker that that of OsFe, the reduction 'cannot be accounted for by the sharing of vacancies between the 4s and 2p shells'. However, such a firm conclusion does not follow from their results. Rather, the vacancy-sharing picture is consistent with available data pertaining to the behaviour of the transient-field in this region.

32784 (CEA-CONF–9219) **Review of the utilization of laser and electron beam methods in the nuclear domain.** Charissoux, C.; Bonnin, P.; Calvet, J.N.; Contre, M. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI). 1987. 20p. (In French). (CONF-8711304–: The laser vs the electron beam in welding, cutting and surface treatment, Harrah's Reno, Nevada, USA, 1-3 Nov 1987). Order Number DE89776433/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The use of laser and electron beams by the nuclear industry for making components, fabricating fuels, waste processing, maintenance, and dismantling installations is reviewed. The advantages in welding include very rapid thermal cycles, deep weld zones with a restricted effect on surrounding material, and reduced residual stress. Surface treatments can also take advantage of these benefits. In cutting, the intrinsic advantages of the laser are completed by its high potential for robotization.

32785 (CONF-8704380–1) **Acoustic studies of solids.** Granato, A.V. Illinois Univ., Urbana, IL (USA). Dept. of Physics. 1987. 25p. Sponsored by DOE Energy Research. DOE Contract AC02-76ER01198. From Conveno celebrativo del 50 anniversairo Dell 'Instituto Di Acustica E commemorotivne Del Fondatore Orso Mario Corbino; Rome, Italy; 28-30 Apr 1987. Order Number DE89011221/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Acoustic technique have proven to be very useful in getting basic information on the configuration and dynamics of defects. Although the technique is indirect, the sensitivity is such that it often competes very favorably with more direct techniques such as neutron, x-ray, or phonon scattering. The symmetry information that comes directly from polarization control often also proves decisive in determining configurations. Many of the concepts that have been developed in explaining the various effects that have been seen in dislocation and

point defect studies have proven also to be very useful when taken over almost directly into other areas of physics. 11 refs., 7 figs.

32786 (DOE/ER/45310–18) **Evidence against the existence of strong diffuse x-ray scattering from gold twist boundaries at room temperature.** Majid, I.; Bristowe, P.D.; Balluffi, R.W. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Materials Science and Engineering. May 1989. 7p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER45310. Order Number DE89012726/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Research on diffuse scattering from twist boundaries in gold is reported. In order to obtain an unambiguous measure of the diffuse scattering from the boundary, we developed a technique in which the total diffuse scattering is measured from the same specimen containing the boundary, and then not containing the boundary, and then determining any difference. This is accomplished by first measuring the diffuse scattering from the bilayer specimen containing the boundary. The specimen is then removed from its polymer film support and annealed gently at 175°C in order to convert the metastable layered bicrystal into a more stable structure consisting of columnar grains separated by short transverse boundaries, as illustrated in Fig. 3(b). In this process, the original flat twist boundary is eliminated. The specimen is then remounted on a polymer film support in as reproducible a manner as possible, and the diffuse scattering is again measured. 13 refs., 6 figs.

32787 (INIS-BR–1483) **Proceedings of the 4. Brazilian School of Semiconductor Physics.** Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. 133p. (In Portuguese). (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Papers on, crystal and film growth, optical spectroscopy, electronic states in superlattices and quantum wells, tunneling, electronic states in bulk, defects in bulk, and defects in superllatices and interfaces, using nuclear techniques are presented. (M.C.K.).

32788 (INIS-BR–1483, pp. 40) **Theoretical study of resonant tunneling in a double barrier structures.** Montenegro, N.P. (Universidade Federal Fluminense, Niteroi, RJ (Brazil). Inst. de Fisica); Anda, E.V. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

TUNNEL EFFECT/crystal structure; AMORPHOUS STATE; ELECTRIC CONDUCTIVITY; GREEN FUNCTION; HAMILTONIANS; KUBO FORMULA; RENORMALIZATION; THREE-DIMENSIONAL CALCULATIONS

32789 (INIS-BR–1483, pp. 46) **Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE).** Basmaji, P. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Li, M.S.; Hipolito, O.; Lavielle, D.; Portal, J.C. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

CRYSTAL GROWTH/electrical properties; CRYSTAL GROWTH/magnetic fields; CRYSTAL GROWTH/substrates; GALLIUM ARSENIDES/aluminium; GALLIUM ARSENIDES/crystal growth; GALLIUM ARSENIDES/tin; SILICON/substrates; ANNEALING; CARRIERS; SUBSTRATES; EPITAXY; ALUMINIUM; TIN; LAYERS; SILICON; X-RAY DIFFRACTION

32790 (INIS-BR–1483, pp. 61) **Microscopic models for (Au-Au) and (Pt-Pt) pair complexes in silicon.** Alves, J.L.A. (Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica); Chacham, H.; Leite, J.R. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

GOLD COMPLEXES/silicon; PLATINUM COMPLEXES/silicon; SILICON/crystal defects; SILICON/electronic structure; SILICON/multiple scattering; CHARGE STATES; SILICON; PAIRING INTERACTIONS; SELF-CONSISTENT FIELD

32791 (INIS-BR–1483, pp. 64) **Charge state stability of interstitial impurities in gallium arsenide.** Scolfaro, L.M.R. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Fazzio, A. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

GALLIUM ARSENIDES/interstitials; INTERSTITIALS/charge states; INTERSTITIALS/impurities; CLUSTER EMISSION MODEL; DIFFUSION; INTERSTITIALS; IMPURITIES; MULTIPLE SCATTERING; TRANSITION ELEMENTS

32792 (INIS-BR–1483, pp. 71) **Density of states of ordered and disordered superlattices.** Klausner, J.C. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). Dept. de Fisica); Roehl, N.M.; Arruda, J.; Davidovich, M.A.; Anda, E.V. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

SUPERLATTICES/hamiltonians; SUPERLATTICES/order-disorder transformations; GREEN FUNCTION; ONE-DIMENSIONAL CALCULATIONS; RENORMALIZATION; SUPERLATTICES; HAMILTONIANS; THREE-DIMENSIONAL CALCULATIONS

32793 (INIS-BR–1483, pp. 39) **Excitons in GaAs-Ga/sub 1-x/Al/sub x/As quantum wells.** Degani, M.H. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Hipolito, O. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

ALUMINIUM/electron-phonon coupling; ALUMINIUM/gallium arsenides; EXCITONS/gallium arsenides; EXCITONS/potentials; EXCITONS/quantum electronics; GALLIUM ARSENIDES/electron-phonon coupling; ALUMINIUM; BINDING ENERGY; EFFECTIVE MASS; ELECTRON-HOLE DROPLETS; EXCITONS; POTENTIALS; QUANTITY RATIO

32794 (INIS-BR–1483, pp. 52) **Plasmon excitations in some II - VI and IV -VI semiconductors.** Oliveira, L.E. (Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica); Muniz, R.B. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

PLASMONS/excitation; PLASMONS/semiconductor materials; SEMICONDUCTOR MATERIALS/plasmons; CADMIUM TELLURIDES; ENERGY LOSSES; LEAD TELLURIDES; MAGNESIUM OXIDES; PERTURBATION THEORY; PLASMONS; EXCITATION; SELF-CONSISTENT FIELD; TIN TELLURIDES; WAVELENGTHS; ZINC SELENIDES; ZINC SULFIDES; ZINC TELLURIDES

32795 (INIS-BR–1511) **Electron paramagnetic resonance in the orthorhombic and tetragonal phases of YBa/sub 2/Cu/sub 3/O/sub x/.** Biasi, R.S. de; Fernandes, A.A.R.; Ferreira, C.L.; Pascual, R.; Saavedra, A. Associacao Brasileira de Ceramica, Sao Paulo, SP (Brazil). 1988. 11p. (In Portuguese). (CONF-8804217–: 32. Brazilian congress on ceramics, Natal, Brazil, 24-27 Apr 1988). Order Number DE89612209/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Electron paramagnetic resonance measurements have been performed on the othorhombic and tetragonal phases of YBa/sub 2/Cu/sub 3/O/sub x/in the temperature range 77-300 K. The results show that the EPR technique can be used to distinguish the two phases. In particular, the zero-field absorption that is observed in the orthorhombic phase at low temperatures seems to be associated with the superconducting state.

32796 (INIS-BR–1520) **Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds.** Prado, F.R. Brasilia Univ., DF (Brazil). Dept. de Fisica. [1989]. 61p. (In Portuguese). Order Number DE89612210/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The dependence of Moessbauer spectra with pH value of Fe(III)HEDTA and Fe(III)CDTA compounds is studied. Informations on formation processes of LFe-O-FeL (L=ligand) type dimers by the relation of titration curves of Fe(III)EDTA, Fe(III)HEDTA and Fe(III)CDTA compounds with the series of Moessbauer spectra, are obtained. Some informations on Fe-O-Fe bond structure are also obtained. Comparing the titration curves with the series of Moessbauer spectra, it is concluded that the dimerization process begins when a specie of the form FeXOH/sup α/(X = EDTA, HEDTA, CDTA; α = -1, -2) arises. (M.C.K.).

32797 (INIS-BR–1530) **Use of overlapped reflection for determining the retained austenite by X-ray diffraction.** Garin, J.L.; Gonzalez, C.F. Associacao Latino-Americana de Metalurgia e Materiais, Rio de Janeiro, RJ (Brazil). 1988. 13p. (In Spanish). (CONF-8811214–: 3. Latin-American colloquium about fatigue and fracture of materials, Rio de Janeiro, Brazil, 27 Nov - 2 dec 1988). Order Number DE89615450/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Retainec austenite in high-carbon steels has been determined by means of new computation techniques applied to the processing of X-ray diffraction data. Instead of using the traditional procedure based on the weak (200) reflections of martensite and austenite, intensity measurements of the overlapped (110) peak of martensite and (111) peak of austenite were performed. The separation of the peaks was based on a Pearson VII function, which is capable of describing all diffraction profiles. The accuracy of integrated intensities was then improved with the beneficial effects of higher precision in the calculation of the amount of retained austenite.

32798 (INIS-mf–11949) **Theory of the critical X-ray and neutron scattering at surfaces.** Gompper, G. Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik. 28 Jun 1986. 132p. (In German). Order Number DE89774713/JAW. Available from NTIS (US Sales Only), PC A07/MF A01.

In the present thesis it is shown that the scattering of X-radiation and neutrons under the condition of total reflection is an ideal instrument for the study of cooperative surface phenomena. It is calculated, how the near-surface critical behaviour of a binary alloy with a continuous order-disorder transition comes out in the scattering cross section. Moreover, superstructure reflection and roughness transitions are investigated. (BHO).

32799 (KIFVE–88-10) **Vibrational spectra of hydrogen containing centers in crystalline silicon.** Tokmoldin, S.Zh.; Mukashev, B.N.; Tamendarov, M.F.; Nazarova, O.A. AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 48p. (In Russian). Order Number DE89615481/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Hydrogen and deuterium were implanted into silicon with different impurities content o,p,s,b,B,aL. oN THE BASIS OF THE ANALYSIS OF HARMONIC AND ANHARMONIC PARTS TO THE FREQUENCIES OF sI-h VIBbration, it is established, that repulsion between H atoms in the vacancy-type defects and distortion of the Si-Si bonds of monohydrids in the interstitial-related centers, respectively, are occured increasing and decreasing on comparison with 2062 cm/sup -1/frequency of Si-H vibration at (3) surfce of Si. It is found, that absorption at 800-900 and 1500-1800 cm/sup -1/regions are identified with vibrations of H/sup +/and H/sup -/ions. It is shown, that H atom has donor level at the upper part of forbidden zone. 41 refs.; 11 figs.; 2 tabs.

32800 (KIYI–88-22) **Study of cooperative processes in polymer gels by the method of slow neutron transmission.** Ivanitskij, P.G.; Klepko, V.V.; Mel'nichenko, Yu.B.; Shilov, V.V. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 23p. (In Russian). Order Number DE89615451/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The procedure of determination of macromolecule friction coefficient and diffusion coefficient of solvent in polymer gels by slow neutron transmission was described. The concentration dependences of indicated parameters in water-soluble gelatin gels in wide range compositions were determined. It was shown that for indicated system the friction coefficient is linearly dependent on gelatin concentration: the dependence of diffusion coefficient on composition is hyperbolic. 11 refs.; 11 figs.

32801 (LBL–26220) **A method for sizing sub-micron particles using small angle diffraction of soft x-rays.** Berkeland, D.J.; Underwood, J.H.; Perera, R.C.C. Lawrence Berkeley Lab., CA (USA). Oct 1988. 70p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE89013353/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The purpose of this work is to develop a method of sizing submicron particles using small-angle soft x-ray diffraction. Solid poly-styrene spheres of known sizes were used as scattering samples, with C-Kα (44.8Å) and V-Lα (24.3Å) radiation from a conventional x-ray source. Two devices were used to diffract the x-rays. One collimates the radiation using a series of pinholes immediately preceding the sample, and directs the unfocussed radiation onto film placed far from the sample. The other utilizes radiation from a single pinhole above the source onto the sample and a spherical multilayer mirror in series, so that the radiation passes twice through the sample and is focused onto film immediately above the pinhole assembly to increase the effective sample area. Using the latter device, two types of diffraction patterns were obtained: a sharp, relatively small pattern from spheres which form a hexagonal lattice structure, and a diffuse, larger pattern from an unordered, or random, array of spheres. Both patterns are presented in this work, along with the calculations, based upon light scattering from an unordered and an ordered array of particles, of the scattering patterns. 9 refs., 32 figs., 2 tabs.

32802 (UCRL–100168) **Comparison of experimental shock-wave profiles for tungsten and computer simulations using a rate-dependent constitutive model.** Steinberg, D.J. Lawrence Livermore National Lab., CA (USA). Dec 1988. 11p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890661–3: 3. international symposium on behavior of media under high dynamic pressures, La Grande Motte, France, 5-9 Jun 1989). Order Number DE89006158/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Steinberg-Guinan-Lund, rate-dependent, constitutive model for Ta has been applied to W. Computer simulation successfully predicts the elastic precursor ahead of the second shock in a series of double-shock experiments. Based on the Cochran-Banner spall model, the spall strength of W is 0.9 $\pm$ 0.1 GPa, independent of loading stress from 10 to 200 GPa. The model provides an explanation of why some quasi-isentropes appear stiffer than the principal Hugoniot. 8 refs., 13 figs.

32803 (UnB-FIS–08/88) **Long-wavelength behaviour of charge-charge structure factor in insulating and metallic ground state of condensed hydrogen under pressure.** Amato, M.A.; March, N.H.; Ceperley, D.M. Brasilia Univ., DF (Brazil). Dept. de Fisica. Sep 1988. 10p. Order Number DE89615478/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Using the quantum Monte Carlo charge-charge structure factor S/sub qq/(k) it is argued that (i) in the metallic phase the small k expasion is non-analytic at order k/sup 5/, reflecting plasmon dispersion, while in the insulating phase the non-analyticity occurs at O(k/sup 3/), due to van der Waals interaction between the protons.

32804 (UnB-FIS–10/88) **Theory of photon-drag effect in bulk magnetic semiconductors.** Rodrigues-Costa, C.; Nunes, O.A.C. Brasilia Univ., DF (Brazil). Dept. de Fisica. Sep 1988. 37p. Order Number DE89612214/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The theory of the photon-drag effect in magnetic semiconducting crystals is considered using the s-d (or s-f) exchange model of interaction between the electron and the magnon. An equation is derived for the electric field generated by this effect. Numerical examples are given for CdCr/sub 2/Se/sub 4/crystals.

32805 Generation and detection of a monolayer grating by laser desorption and second-harmonic generation: CO on Ni(111). Zhu, X. D. (Department of Physics, Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720(US)); Shen, Y. R. *Optics Letters (USA),* 14(10): 503-505 (15 May 1989). DOE Contract AC03-76SF00098.

We show that a monolayer grating of CO on Ni(111) can be generated by laser desorption using two interfering laser pulses and detected and characterized in situ by surface second-harmonic generation.

32806 Comment on "Kinetics of random sequential adsorption". Evans, J. W. (Ames Laboratory and Department of Physics, Iowa State University, Ames, Iowa 50011(US)). *Physical Review Letters (USA),* 62(22): 2642-2642 (29 May 1989). DOE Contract W-7405-ENG-82.

A Comment on the Letter by P. Schaaf and J. Talbot, Phys. Rev. Lett. 62, 175 (1989).

32807 Rotationally inelastic scattering of N_2 from clean and hydrogen covered Pd(111). Lykke, K. R. (Sandia National Laboratories, Albuquerque, New Mexico 87185(US)); Kay, B. D. *Journal of Chemical Physics (USA),* 90(12): 7602-7603 (15 Jun 1989).

Quantum-resolved molecular beam–surface scattering from clean and hydrogen covered Pd(111) is shown to be a sensitive dynamical probe of changes in the gas–surface interaction potential brought about by the presence of chemisorbed surface hydrogen. In particular, the specular scattering of N_2 from hydrogen covered Pd(111) is appreciably less inelastic rotationally than scattering from the clean surface. The specularly scattered rotationally elastic channel is utilized as a nonperturbative probe of the surface chemisorbed hydrogen coverage during a temperature programmed desorption (TPD) experiment.

32808 Phase diagram of the Hubbard model: A variational wave-function approach. Coppersmith, S. N. (AT&T Bell Laboratories, 600 Mountain Avenue, Murray Hill, New Jersey 07974(US)); Yu, C. C. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11464-11474 (1 Jun 1989).

We explore the phase diagram of the Hubbard model by generalizing the Gutzwiller variational wave function to take into account nearest-neighbor spin correlations. The energies of various variational states are calculated and compared. At half filling the lowest energy state has long-range antiferromagnetic correlations, in agreement with previous results. Away from half filling, when the antiferromagnet no longer has the lowest energy, the Gutzwiller approximation yields a lower energy than that found for small spin polarons.

32809 Grain-boundary ordering, segregation, and melting transitions in a two-dimensional lattice-gas model. Farkas, D. (Department of Materials Engineering, Virginia Polytechnic Institute State University, Blacksburg, Virginia 24061(US)); Jang, H. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11769-11774 (1 Jun 1989).

A two-dimensional lattice-gas model of a binary-ordering-alloy system was used to study the phase transitions and the atomic configuration near a Σ=5 grain boundary. The cluster variation method was used to study order-disorder and melting transitions in the bulk alloys. The complete binary phase diagrams were constructed for two different sets of interaction-energy assumptions. Simulations based on the same model were performed to study these transitions in the grain-boundary region. In addition, the model also yields information on the segregation behavior of the alloying elements in the grain-boundary region.

32810 Stochastic theory of diffusional planar-atomic clustering and its application to dislocation loops. Ghoniem, N. M. (Mechanical, Aerospace and Nuclear Engineering Department, University of California, Los Angeles, Los Angeles, California 90024(US)). *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11810-11819 (1 Jun 1989).

Atomic clustering into circular planar disks is an important process responsible for interstitial- loop formation in the bulk of irradiated materials, and the evolution of atomic planes during thin-film growth. We develop a stochastic theory for the formation of planar-atomic clusters by atomic diffusion. The theory accounts for the transient coupling between master equations representing small-size atomic clusters and a Fokker-Planck (FP) equation for larger ones. The FP equation is solved self-consistently, together with the master equations by the moments method. Equations for the rates of change of atomic species and for the nucleation rate of atomic clusters are simultaneously solved with appropriate equations for the average size and various moments of the distribution function. An application of the theory is given by comparing the results of calculations with experimental data on interstitial-loop formation in ion-irradiated nickel.

32811 Vortices in the classical two-dimensional anisotropic Heisenberg model. Gouv@/re@ (Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); xa, M. E.; Wysin, G. M.; Bishop, A. R.; Mertens, F. G. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11840-11849 (1 Jun 1989).

The structure and dynamics of vortex spin configurations are considered for a two-dimensional classical Heisenberg model with easy-plane anisotropy. Using both approximate analytic methods based on a continuum description and direct numerical simulations on a discrete lattice, two types of static vortices (planar and out-of-plane) are identified. Planar (out-of-plane) vortices are stable below (above) a critical anisotropy. The structure of moving vortices is calculated approximately in a continuum limit. Vortex-vortex interactions are investigated numerically. A phenomenology for dynamic structure factors is developed based on a dilute gas of mobile vortices above the Kosterlitz-Thouless transition. This yields a central peak scattering whose form is compared with the results of a large-scale Monte Carlo–molecular-dynamics simulation.

32812 Saturation of intersubband transitions in *p*-type semiconductor quantum wells. Chang, Y. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801(US)); James, R. B. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12672-12681 (15 Jun 1989).

Saturation behavior of intersubband optical transitions in *p*-typesemiconductor quantum wells is examined theoretically with the multibandeffective-mass model. Carrier-phonon scatterings are taken into account withinthe deformation-potential approximation. Deviation of the hole distributionfrom thermal equilibrium due to optical pumping is calculated by solvingcoupled rate equations. Pump-and-probe absorption spectra are also studied, andpossible applications for light-by-light modulation are discussed.

32813 Comparison of optimization methods for electronic-structure calculations. Garner, J. (Materials Science Division, Argonne National Laboratory, Argonne, Illinois 60439(US)); Das, S. G.; Min, B. I.; Woodward, C.; Benedek, R. *Physical Review [Section] B: Condensed Matter (USA),* 39(17): 12899-12902 (15 Jun 1989). DOE Contract W-31-109-ENG-38.

The performance of several local-optimization methods for calculatingelectronic structure is compared. The fictitious first-order equation of motionproposed by Williams and Soler is integrated numerically by three procedures:simple finite-difference integration, approximate analytical integration (theWilliams-Soler algorithm), and the Born perturbation series. These techniquesare applied to a model problem for which exact solutions are known, the Mathieuequation. The Williams-Soler algorithm and the second Born approximationconverge equally rapidly, but the former involves considerably lesscomputational effort and gives a more accurate converged solution. Applicationof the method of conjugate gradients to the Mathieu equation is discussed.

32814 Numerical simulations of hopping conductivity using nonflat densities of states. Shegelski, M. R. A. (Department of Physics, Dalhousie University, Halifax, Nova Scotia, Canada B3H 3J5(CA)); Zimmerman, D. S. *Physical Review [Section] B: Condensed Matter (USA),* 39(18): 13411-13419 (15 Jun 1989).

We report numerical simulations of hopping conduction in lightly dopedsemiconductors. We model the hopping using a Miller-Abrahams resistor network.We investigate the effect of the density of states (DOS) on the temperaturedependence of the hopping conductivity $\sigma(T)$ in a regime oftemperature T well above the regime associated with variable-rangehopping (VRH). In this "high-T " regime, we study a "peaked" DOS anda "flat-flat" DOS. The "peaked" DOS has a maximum at the T=0 Kchemical potential μ_0 and decreases away fromμ_0.

32815 **High-order corrections to the image potential.** Zheng, X. (University of Tennessee, Knoxville, Tennessee 37996(US)); Ritchie, R. H.; Manson, J. R. *Physical Review [Section] B: Condensed Matter (USA),* 39(18): 13510-13513 (15 Jun 1989). DOE Contract AC05-84OR21400.

A self-energy formalism for determining the image potential for a chargeoutside of a metal is generalized to include high-order corrections. In thisfirst systematic development of the image potential in higher-orderperturbation theory, the image potential is given as an asymptotic series ininverse powers of the distance of the charge from the surface.

6561 Superconductivity

Refer also to citation(s) 31252, 31281, 31300, 31301, 31305, 31306, 31307, 31309, 31310, 31311, 31312, 31313, 31371, 31393

32816 (KU-HCOE-FL2-R–88-25) **Chaotic noise in superconducting microbridge 4-photon X-band parametric amplifier.** Andresen, J.E.; Christiansen, B.; Levinsen, M.T. Copenhagen Univ. (Denmark). H.C. Oersted Inst. 5 Dec 1988. 40p. Order Number DE89775035/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The anomalous noise rise observed in nearly all types of parametric amplifiers based on Josephson junctions has been an intriguing as well as annoying problem for many years. This phenomenon has been most spectacular in microbridge amplifiers. Here we present measurements on externally pumped single microbridge 4-photon unbiased amplifiers, where the slit with the bridge is used as a slotline resonantly coupled to the waveguide in an exceptionally simple coupling scheme. This scheme may be of interest in itself, particularly if the noise problem can be overcome, but also in other connections. Up to 16 dB gain was obtained at the top of the waveguide. However, the noise rise was observed as usual. An analog computer study on a model including an input/output circiut was performed. The results are in very good agreement with the experiments. The amplification is heralded by a seemingly chaotic noise rise. This noise is then amplified linearly when gain occurs. Amplification is found to take place very close to where the supercurrent is completely suppressed by the pump. This has previously been interpreted as loss of phaselock being the cause of the noise rise. However, the power spectra of the time-derivative of the phase show the still to be locked in the region of positive gain. Furthermore, computations of the Lyapunov exponents show one to be positive in the region where gain occurs reaching a maximum value at the parameters corresponding to maximum gain. We therefore conclude that chaotic noise is indeed present in Josephson junction parametric amplifiers where low-impedance devices like microbridges with negligible capacitance are used as the active elements.

32817 **Field structure of vortex lattices in uniaxial superconductors.** Thiemann, S. L. (Ames Laboratory and Physics Department of Iowa State University, Ames, Iowa 50011(US)); Radovic, Z.; Kogan, V. G. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11406-11412 (1 Jun 1989). DOE Contract W-7405-ENG-82.

The magnetic field distribution within a primitive cell of the equilibrium flux-line lattice of a uniaxial superconductor is obtained for any orientation of vortex axes within the crystal in intermediate fields. The numerical procedure is described for mapping of both longitudinal and transverse field components with respect to the vortex axes (or to the direction of the induction **B**, which is the same). For a general orientation of **B** within the crystal, the transverse field, which is comparable in value to the longitudinal one in low fields, becomes small with respect to B in intermediate fields, but remains comparable to the variable part of the longitudinal component. The nuclear magnetic resonance line shapes are discussed for an arbitrary orientation of an intermediate external field.

32818 **Assessment of Fermi-liquid description for the normal state of high-T_c superconductors.** Kim, J. H. (Department of Physics, The University of Chicago, James Franck Institute, Chicago, Illinois 60637(US)); Levin, K.; Auerbach, A. *Physical Review [Section] B: Condensed Matter (USA),* 39(16): 11633-11647 (1 Jun 1989). DOE Contract AC02-76CH00016.

The applicability of Fermi-liquid theory for the normal state of the high-T_c copper oxides is investigated. In the present context "Fermi-liquid theory" refers to a description in which there are two components (copper and oxygen) within the Fermi surface. This is to be contrasted with other approaches in which the Cu electrons are fully localized. Our calculations are based on a Coulomb renormalized band structure which characterizes the quasiparticle energies. This band structure arises from a variety of different but essentially equivalent mean-field techniques. The present focus is on deriving a Fermi-liquid description which combines both Coulomb-induced localization (as a precursor to the insulating state) with semirealistic band structure. The latter requires that next-nearest-neighbor oxygen-oxygen overlap integrals also be included in a tight-binding scheme. The interplay of these two effects leads to (i) a positive Hall coefficient which becomes progressively larger as the insulator is approached and reverses its sign for large doping concentration; (ii) a "pinning" of the Cu valence near the Cu^{2+} state; (iii) two important features in the density of states, one of which can be associated with the van Hove singularities and the other with band narrowing or incipient localization effects. The former occur away from the half-filled limit as a result of oxygen-oxygen overlap processes, so that the perfect nesting of the nearest-neighbor half-filled tight-binding model is significantly offset. The latter leads to a strong prediction of the theory: as in the Brinkman-Rice picture, incipient localization effects will be manifested by a progressively larger Sommerfeld coefficient γ as the insulator is approached. This prediction needs to be tested experimentally.

6570 Theoretical and Mathematical Physics

Refer also to citation(s) 32632, 33031

32819 (ANL-HEP-CP–88-84) **Fermionic center in the superconformal algebra on the supertorus.** Zachos, C.K. Argonne National Lab., IL (USA). High Energy Physics Div. 1988. 13p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8807167–1: 4. international workshop on recent developments in high energy physics, Chania, Greece, 1-10 Jul 1988). Order Number DE89013273/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Krichever and Novikov (KN) have introduced a generalization of the Virasoro algebra which describes conformal transformations on a Riemann surface of arbitrary genus. We examine their genus one algebra, find explicit expressions for its center, and discuss connections and symmetries among the algebra constants. We then proceed to construct explicitly the corresponding superconformal algebra on the supertorus. An intriguing feature of the NS odd spin structure algebra is that it is enriched by a central element which is anticommuting. 6 refs.

32820 (IC–88/377) **Erratic time dependence of orbits of topologically mixing maps.** Xiong Jincheng. International Centre for Theoretical Physics, Trieste (Italy). Nov 1988. 14p. Order Number DE89611893/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the present paper we show that for a topologically mixing map there are considerably many points in the domain whose orbits display highly erratic time dependence, i.e., if f: X->X is a topologically mixing map where X is a compact metric space then for any increasing sequence q/sub i/of positive integers and any countable subset S dense in X there exists everywhere an uncountable subset C of X satisfying the conditions of (1) for any s is an element of S. There exists a subsequence p/sub i/of the sequence q/sub i/such that lim/sub i->∞/f/sup P/sub 1/(y)=s for every y is an element of C, and (2) for any n>0, any n distinct points y/sub 1/,y/sub 2/,...,y/sub n/of

C and any n points x/sub 1/,x/sub 2/,...,x/sub n/of X there exists a subsequence t/sub i/of the sequence q/sub i/such that lim/sub i->oo/ f/sup t/i/sub i/y/sub j/=x/sub j/for every j=1,2,...n. (author). 4 refs.

32821 (INFN-AE–88-13) **Fifth force, sixth force and all that. A theoretical (classical) approach.** Recami, E.; Tonin Zanchin, V. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1988. 7p. Order Number DE89611970/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In the recent literature, a few claims appeared about possible deviations from the ordinary gravitational laws (both at the terrestrial and at the galactic level). The experimental evidence does not seem to be conclusive; nor its is clear if new forces are showing up, or if we have to accept actual deviations from Newton or Einstein gravitation (in the latter case, the validity of the very Equivalence Principle might be on the stage). In such a situation, the attempts by various authors at explaining the "new effects" just on the basis of the ordinary theory of General Relativity (for instance, in terms of quantum gravity) can be regarded as logically instance, in terms of quantum gravity can be regarded as logically questionable. In this pedagogically oriented paper, the problem is approached within the classical realm, by exploring whether the possible new effects can be accounted for through minimal modifications of the standard formulatiaon of General Relativity: in particular, through exploitation and extension of the role of the cosmological constant.

32822 (INIS-BR–1483, pp. 34) **Landau levels and cyclotron masses in Ga Al-Al Ga As quantum wells.** Dios L, M. de (Havana Univ. (Cuba). Dept. of Pheoretical Physics); Lopez G, J.; Sabin del V, J. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

HAMILTONIANS/anisotropy; HAMILTONIANS/gallium arsenides; HAMILTONIANS/quantum mechanics; QUANTUM MECHANICS/electrons; QUANTUM MECHANICS/gallium arsenides; QUANTUM MECHANICS/magnetic fields; ALUMINIUM COMPOUNDS; HAMILTONIANS; ANISOTROPY; NUMERICAL SOLUTION; ELECTRONS; TWO-DIMENSIONAL CALCULATIONS

32823 (INIS-BR–1483, pp. 41) **Quantization of position dependent hamiltonians in the Feynman path integral formalism.** Aladim, S.R. (Sao Carlos Univ., SP (Brazil). Dept. de Fisica); Marques, G.E.; Mizrahi, S.S. Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica. 1989. (CONF-8901126–: 4. Brazilian school of semiconductor physics, Belo Horizonte, Brazil, 23 Jan - 3 feb 1989). In *Proceedings of the 4. Brazilian School of Semiconductor Physics.* Order Number DE89612194/JAW. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

HAMILTONIANS/feynman path integral; HAMILTONIANS/quantization; HAMILTONIANS/space dependence; ALUMINIUM; BOUNDARY CONDITIONS; GALLIUM ARSENIDES; HAMILTONIANS; QUANTIZATION; MASS; TRANSMISSION

32824 (INIS-SU–74/A) **Methods and programs for numerical solution of the mathematical physics problems. Scientific-technical collection.** Sofronov, I.D. (ed.). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR); Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR). 1987. 99p. (In Russian). Order Number DE89012113/JAW. Available from NTIS (US Sales Only), PC A05/MF A01.

Individual papers in this collection are indexed separately.

32825 (IYaF–88-35) **Does static solution exist for a gravitating flat wall.** Dolgov, A.D.; Khriplovich, I.B. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 6p. Order Number DE89615361/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

It is shown that under general assumptions no static nonsingular solution of the General Relativity equations exists for the graviational field of uniformly flat matter distribution. 5 refs.

32826 (IYaF–88-45) **Intermediate statistics of quasienergy spectrum and quantum localization of classical chaos.** Izrajlev, F.M. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 22p. (In Russian). Order Number DE89615344/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A study is made on statistics of quasienergy spectrum for a simple quantum model with a finite number of levels under the conditions, when the motion of corresponding classical system is totally chaotic, whereas quantum chaos is not limiting due to localization effect. It is shown that this case the distribution of distances between neighbouring levels of quasienergy depends effectively only on one parameter equal to the ratio of dimensiality of chaotic eigenfunctions (of the average localization length) to the total number os system levels. Correlation with numerical data, data obtained in wide range of model parameters is conducted. 28 refs.; 9 figs.

32827 (IYaF–88-47) **On stochastic quantization.** Tsel'nik, F.A. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 12p. (In Russian). Order Number DE89615345/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In stochastic mechanics a concept concerning the universal character of diffusion appears to be a source one: all the bodies move along random trajectories with diffusion coefficient. A hypothesis concerning the universal brownian movement is interpreted in terms of traditional quantum theory concepts linking the statistical character of description with incontrollable particle interaction with the measuring instrument. 5 refs.

32828 (KU-HCOE-FL2-R–88-22) **Role of localization within the vortex picture of the fractional quantum Hall effect.** Bruus, H.; Hansen, O.P.; Hansen, E.B. Copenhagen Univ. (Denmark). H.C. Oersted Inst. 18 Nov 1988. 10p. Order Number DE89775037/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

Plateau formation in the fractional quantum Hall effect is shown to arise because, by pinning of vortices in the incompressible electron liquid, the canonical filling factor can be stationarily maintained in the interconnected region between the vortices. The crucial role of localization is demonstrated by considering the idealized limit where pinning centres are absent.

32829 (KU-HCOE-FL2-R–88-24) **Non-chaotic transition from quasiperiodicity to complete phase-locking.** Alstroem, P.; Christiansen, B.; Levinsen, M.T. Copenhagen Univ. (Denmark). H.C. Oersted Inst. 1988. 14p. Available from Also published in Phys. Rev. Lett. (10 Oct 1988) v. 61(15) p. 1679-1682.

We show the existence of a generic integrate-and-fire phenomenon which separates the transition to complete phase-locking from the transition to chaos. We argue that our picture provides a natural explanation of 'missing' hysteretic bands in the Belousov-Zhabotinskii reaction. In addition, we explain the origin of experimentally observed 'deviations from universality' and pumps in the Arnold tongues in driven relaxation oscillators.

32830 (KU-HCOE-FL2-R–88-26) **Characterization of modulated integrate-and-fire systems.** Alstroem, P.; Christiansen, B.; Levinsen, M.T. Copenhagen Univ. (Denmark). H.C. Oersted Inst. 4 Nov 1988. 38p. Order Number DE89775034/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

The phase locking structure in threshold modulated integrate-and-fire systems is explored. The existence of a smooth critical line where the Poincare map has an infinite slope inflection point is emphasized. At and below this line the system is related to circle map systems. Especially, this allows realization of systems with higher order scaling structures, qualitatively distinct from ordinary third order circle map structures. Hourglass patterns develop in parameter space and at small modulation amplitudes the behavior of the phase-locking regions (Arnold tongues) change dramatically. Above the critical line the Arnold tongues complete the parameter space, leaving along any line a zero-dimensional Cantor set of points associated with irrational rotation numbers. The critical line is not associated with a transition to chaos. In particular non-chaotic regions with complete phase-locking exist. In the supercritical region a gap is present in the Poincare map. The features at this gap are examined. Also local hysteresis may occur. We discuss the applicability of the local approximation.

32831 (KU-HCOE-FL2-R-88-27) **Local hysteresis in relaxation oscillators.** Alstroem, P.; Christiansen, B.; Levinsen, M.T. Copenhagen Univ. (Denmark). H.C. Oersted Inst. 4 Nov 1988. 18p. Order Number DE89775033/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Relaxation oscillations or 'integrate and fire' phenomena are very commonly found in nature. When modulated by an external force a global hysteresis connected with chaos is often encountered. Besides this kind of hysteresis a local form is found in some systems. We describe briefly the difference and the circumstances under which to observe local hysteresis. A specific system treated in detail is the Fohlmeister model, originally derived to describe a neuronal encoder. In the limit of small damping an analytical solution is obtained. Furthermore, we derive an upper limit to the hysteresis. The results are compared to numerical calculations on the full system and agree quite well. In contrast to e.g. the driven damped pendulum equation the hysteresis is limited in size as compared to the phase-locked region.

32832 (KU-HCOE-FL2-R-89-5) **Quantum Hall effect and the electrostatic Aharonov-Bohm effect.** Lindelof, P.E. Copenhagen Univ. (Denmark). H.C. Oersted Inst. 1989. 9p. Order Number DE89775038/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

In this letter the gauge invariance of the integral over time of the electrostatic potential (the electrostatic Aharonov-Bohm effect) is used to elucidate the quantum Hall effect. Our discussion uses the Laughlin geometry. For real samples edge currents as well as currents along internal boundaries play a crucial role.

32833 (KU-HCOE-FL2-R-89-7) **Tunneling through a time-modulated barrier - relation to tunneling times.** Jauho, A.P.; Jonson, M. Copenhagen Univ. (Denmark). H.C. Oersted Inst.; Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. of Theoretical Physics. 1989. 14p. Order Number DE89775046/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

We analyze tunneling through a time-modulated barrier, where transmitted particles may have absorbed or emitted modulation quanta. Buettiker and Landauer (BL) have suggested using the intensities of the side-bands to define a tunneling time. Our numerical simulations quantitatively confirm the analytical results of BL for these intensities. However, no cross-over at finite modulation frequency between distinct high-and low-frequency regions is found. Hence the procedure suggested by BL is, without refinements, unsuitable for defining a tunneling time. Furthermore, we examine analytically the transmitted wave-function in the adiabatic limit, and show that the related density and current involve both the dwell time, and the Buettiker time, defined in the context of a Larmor clock. This suggests the possibility that experiments, probing different aspects of the transmitted wave-function may yield different, but complementary information about the tunneling process.

32834 (LAPP-EXP-88-05) **Capacitive device approach to gravitational wave detection.** Mours, B.; Yvert, M. Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules. May 1988. 6p. Order Number DE89776491/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The possible use of a capacitive device to detect gravitational waves is discussed. Special emphasis is put on the detection of permanent periodic sources. The intrinsic properties of such a method, its sensitivity, directionality and its wide frequency band, makes it a very appealing one.

32835 (LA-UR-89-1604) **Momentum distributions: An overview.** Sokol, P.E.; Silver, R.N.; Clark, J.W. Los Alamos National Lab., NM (USA). 1989. 35p. Sponsored by DOE/ER;OGA. DOE Contract W-7405-ENG-36;W-31109-ENG-38. (CONF-8810118–7: Workshop on momentum distributions, Argonne, Illinois, USA, 24-26 Oct 1988). Order Number DE89012617/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There have been several excellent reviews of momentum-distribution research in particular subject areas of physics such as electronic systems and nuclear systems. However, it is the commonality of interests, difficulties, and prospects across all of physics, along with certain pivotal advances, which led to the organization of an interdisciplinary Workshop on Momentum Distributions held at Argonne National Laboratory on October 24–26, 1988. The purpose of this overview is to explain why scientists with such diverse backgrounds have been brought together at this meeting, to introduce and discuss the common elements of momentum-distribution studies, and to establish a common language. We hope to facilitate an appreciation of the more specialized articles which follow in these proceedings. We begin by summarizing the general properties of momentum distributions. Differences and similarities of atomic, electronic, and nuclear many-body systems are examined, in terms of characteristic lengths and energies, relative importance of exchange, and the nature of the two-particle interactions. We continue with a brief commentary on the microscopic methods used to calculate n(p) from first principles. Thereafter, the discussion focuses on the ideas, techniques, and issues involved in the experimental determination of the momentum distribution: deep-inelastic scattering, the impulse approximation, Y-scaling, final-state effects, and scale breaking. Finally, some typical examples of theoretical and experimental momentum distributions will be presented and compared, for a variety of systems. 63 refs., 16 figs.

32836 (LPNHE–8701) **Neutrino oscillations at accelerators. Past results, future prospects.** Vannucci, F. Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies; Paris-7 Univ., 75 (France). 1987. 11p. (CONF-8702174–: BNL neutrino workshop, Upton, New York, USA, 5-7 Feb 1987). Order Number DE89776431/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Test on masses of neutrinos below the 1 eV level are reviewed, and the limits of present experimental methods used to look for neutrino oscillations are discussed. A tagged neutrino experiment is suggested. The usual neutrino detector is supplemented by a first detector (the tagger). In an ideal situation, the neutrino flavor is known event by event, and is known at the point of production. It is possible to reconstruct the point of meson decay and thus the source of each neutrino.

32837 (PPPL–2619) **Mapping in inertial frames.** Arunasalam, V. Princeton Univ., NJ (USA). Plasma Physics Lab. May 1989. 22p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89013320/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

World space mapping in inertial frames is used to examine the Lorentz covariance of symmetry operations. It is found that the Galilean invariant concepts of simultaneity (S), parity (P), and time reversal symmetry (T) are not Lorentz covariant concepts for inertial observers. That is, just as the concept of simultaneity has no significance independent of the Lorentz inertial frame, likewise so are the concepts of parity and time reversal. However, the world parity (W) [i.e., the space-time reversal symmetry (P-T)] is a truly Lorentz covariant concept. Indeed, it is shown that only those mapping matrices M that commute with the Lorentz transformation matrix L (i.e., $[M,L] = 0$) are the ones that correspond to manifestly Lorentz covariant operations. This result is in accordance with the spirit of the world space Mach's principle. Since the Lorentz transformation is an orthogonal transformation while the Galilean transformation is not an orthogonal transformation, the formal relativistic space-time mapping theory used here does not have a corresponding non-relativistic counterpart. 12 refs.

32838 (SFB–237-39(prepr.)) **Euclidean quantum mechanics: Analytical approach.** Albeverio, S.; Yasue, K.; Zambrini, J.C. Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen; Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS). Jan 1989. 58p. Available from Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen.

We give a Hilbert space picture of a novel probabilistic interpretation of the classical heat equation, realizing an idea of Schroedinger. By this we also obtain an Euclidean version of non relativistic Quantum Mechanics, distinct from the one obtained using the Feynman-Kac formula.

32839 (UCRL–97838) **New electromagnetic directed energy pulses.** Ziolkowski, R.W. Lawrence Livermore National Lab., CA (USA). 19 Jan 1988. 8p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-880110–37: SPIE O-E

Lase '88: optoelectronics and laser applications in science and engineering, Los Angeles, California, USA, 10-17 Jan 1988). Order Number DE89013188/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

New electromagnetic directed energy pulse train (EDEPT) solutions of Maxwell's equations have been obtained. One particular solution, the modified power spectrum (MPS) pulse, will be described in detail. This pulse can be tailored to give directed energy transfer in space in such a manner that theoretically it beats the diffraction limit. These EDEPT solutions are not physically pathological and can be reconstructed from causal Green's functions. They represent fields that recover their initial amplitudes along the direction of propagation out to extremely large distances from their initial location. Moreover, these fields appear to be launchable from finite aperture antennas. 6 refs., 7 figs.

32840 (UCRL–100192) **Characterization of radiation boundary conditions used in the finite-difference time-domain method.** Ray, S.L. Lawrence Livermore National Lab., CA (USA). 29 Dec 1988. 6p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890660–1: Institute of Electrical and Electronics Engineers (IEEE) Antennas Propagation Society (AP-S) international symposium, San Jose, California, USA, 26-30 Jun 1989). Order Number DE89005662/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

When the finite-difference time-domain (FDTD) method is applied to open region scattering and coupling problems, some artificial mechanism must be employed to simulate the infinite region on the necessarily finite spatial grid. The current method of choice is to use a radiation boundary condition (RBC) based on an approximate one-way wave equation. This popularity is due to several factors; these RBC's are local in space, (usually) explicit in time, and can be quite accurate. Typically, these RBC's are tested numerically. A pulse is launched from a local region on the interior of an FDTD grid and allowed to propagate out of the problem space. The reflected field is measure after an appropriate clear-time, providing a measure of the RBC's effectiveness. Unfortunately, it is difficult to extract precise information relating the RBC error to the frequency and angle of incidence of the outgoing wave and to the cell and time step sizes from this type of measurement. An alternate, analytic, approach to testing RBC's is presented in this paper. This approach provides a more effective means of characterizing various RBC's and comparing their accuracy in different parameter regimes. 3 refs., 3 figs.

32841 (UCRL–100883) **Radiation from waves guided by nonuniform active surfaces.** King, R.J. Lawrence Livermore National Lab., CA (USA). Apr 1989. 4p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890660–7: Institute of Electrical and Electronics Engineers (IEEE) Antennas Propagation Society (AP-S) international symposium, San Jose, California, USA, 26-30 Jun 1989). Order Number DE89012286/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The concept of electronically manipulating the complex wave numbers of waves launched along guiding surfaces is intriguing and appropriate for this special session on new trends. Coupled with the fact that technology for designing and constructing nonuniform and active wave-guiding surfaces is not yet developed has precluded wide knowledge or acceptance of these concepts. Nevertheless, the concepts are still unique and worthy of re-examination within the realm of feasible but undeveloped ideas. 6 refs., 4 figs.

32842 (UCRL–101001) **A test of Newton's Law of Gravity using the BREN Tower, Nevada.** Kasameyer, P.; Thomas, J.; Fackler, O.; Mugge, M.; Kammeraad, J.; Millett, M.; Harris, B.; Felske, D. Lawrence Livermore National Lab., CA (USA). 22 May 1989. 14p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48;AC03-81ER40050. (CONF-890199–5: 8. Moriond workshop on tests of fundamental laws in physics, Les Arcs, France, Jan 1989). Order Number DE89013262/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We predicted gravity values on a tower by upward continuing an extensive set of surface data in order to test the $1/r^2$ dependence of Newton's Law of Universal Gravitation. We measured gravity at 12 heights up to 454 m on a tower at the Nevada Test Site, and at 91 locations on the surface of the earth within 2.5 kilometers of the tower. These data have been combined with 60,000 surface gravity measurements within 300 kilometers of the tower and have been used to predict the gravitational field on the tower via a solution of Laplace's equation. A discrepancy between the observed gravity values and the prediction could suggest a breakdown of Newtonian Gravity, but we observe none. Our preliminary results are consistent with the Newtonian hypothesis to within 93 $\pm$ 95 μgals at the top of the tower, a result which conflicts with the previously reported 500 μgal non-Newtonian signal seen at 562 meters above the earth. 24 refs., 2 figs.

32843 A systematic study of the Toda lattice. Das, A. (School of Natural Sciences, Institute for Advanced Study, Princeton, New Jersey 08540(US)); Okubo, S. *Annals of Physics (New York) (USA)*, 190(2): 215-232 (Mar 1989).

We apply the results of our recent investigation of integrable modelsto the particular case of the Toda lattice. We obtain the conserved quantitiesin closed form and derive the recursion relation which leads to theirinvolution. We compare our Lax equation with the conventional and present thehigher order Lax equations also in a closed form.© 1989 Academic Press, Inc.

32844 Resonance fluorescence and quantum jumps in single atoms: Testing the randomness of quantum mechanics. Erber, T. (Department of Physics, University of California, Los Angeles, California 90024(US)); Hammerling, P.; Hockney, G.; Porrati, M.; Putterman, S. *Annals of Physics (New York) (USA)*, 190(2): 254-309 (Mar 1989).

When a single trapped $^{198}Hg^+$ ion is illuminated by two lasers,each tuned to an approximate transition, the resulting fluorescence switches*on* and *off* in a series of pulses resembling a bistable telegraph.This intermittent fluorescence can also be obtained by optical pumpingwith a single laser. Quantum jumps between successive atomic levels may betraced directly with multiple-resonance fluorescence. Atomic transition ratesand photon antibunching distributions can be inferred from the pulse statisticsand compared with quantum theory. Stochastic tests also indicate that thequantum telegraphs are good random number generators. During periods whenthe fluorescence is switched *off*, the radiationless atomic currentsthat generate the telegraph signals can be adjusted by varying the laserillumination: if this coherent evolution of the wave functions is sustainedover sufficiently long time intervals, novel *interactive* precisionmeasurements, near the limits of the time-energy uncertainty relations, arepossible.© 1989 Academic Press, Inc.

32845 Simple spectral method for solving propagation problems in cylindrical geometry with fast Fourier transforms. Feit, M. D. (Lawrence Livermore National Laboratory, Livermore, California 94550(US)); Fleck, J. A., Jr. *Optics Letters (USA)*, 14(13): 662-664 (1 Jul 1989). DOE Contract W-7405-ENG-48.

We describe a spectral method for solving the paraxial wave equation incylindrical geometry that is based on expansion of the exponential evolutionoperator in a Taylor series and use of fast Fourier transforms to evaluatederivatives. A fourth-order expansion gives excellent agreement with atwo-transverse-dimensional split-operator calculation at a fraction of the costin computation time per z step and at a considerable savings in storage.

32846 Applications of Bohr's correspondence principle. Crawford, F. S. (Lawrence Berkeley Laboratory and Physics Department, University of California, Berkeley, California 94720(US)). *American Journal of Physics (USA)*, 57(7): 621-628 (Jul 1989).

The Bohr correspondence-principle (cp) formula $dE/dn=\hbar\omega$ is presented (ω is the classical angular frequency) and its predicted energy levels E_n are compared to those given by the stationary state solutions of the Schrödinger equation, first for several examples in one dimension (1D), including the "quantum bouncer," and then for several examples in three dimensions (3D), including the hydrogen atom and the isotropic harmonic oscillator. For the 3-D cases, the cp predictions based on classical circular orbits are compared with the "circlelike" Schrödinger solutions (those with the lowest energy eigenvalue for a given l) and the cp predictions based on classical "needle" orbits (having zero angular momentum) with the Schrödinger l=0 solutions. For the H atom and the isotropic oscillator, the cp prediction does not depend on the classical orbit chosen because of a "degeneracy": the fact that for these systems ω is independent of the orbit. As a more stringent test of the cp,

analogous nondegenerate systems $V=-kr^{3/2}$ in place of the H-atom potential $V=-e^2/r$ and $V=kr^4$ in place of the oscillator potential $V=(1/2)m\omega^2 r2$ are therefore considered. Aninteresting anomaly that occurs for the harmonic oscillator and itsnondegenerate analog $V=kr^4$ is encountered (but not for the H atomnor its nondegenerate analog $V=-kr^{3/2}$), wherein half of thestates predicted by application of the cp to the needle orbits are "spurious"in that there are no corresponding Schrödinger $l=0$ states.

32847 Lossless propagation of optical pulses through *N*-level systems with Gell-Mann symmetry. Hioe, F. T. (Department of Physics, St. John Fisher College, Rochester, New York 14618(US)). *Journal of the Optical Society of America B: Optical Physics (USA),* 6(6): 1245-1252 (Jun 1989).

Propagation of optical pulses through atomic media consisting of atoms with*N* transition levels and possessing the so-called Gell-Mann symmetry isstudied. An analytic solution of the appropriate Maxwell–Bloch equationshaving the form of simultaneous different wavelength optical solitons ispresented. The special case of $N=3$ was known previously.

32848 A new perturbative approach to nonlinear problems. Bender, C. M. (Department of Physics, Washington University, St. Louis, Missouri 63130(US)); Milton, K. A.; Pinsky, S. S.; Simmons, L. M., Jr. *Journal of Mathematical Physics (New York) (USA),* 30(7): 1447-1455 (Jul 1989).

A recently proposed perturbative technique for quantum field theory consistsof replacing nonlinear terms in the Lagrangian such as ϕ^4 by$(\phi^2)^{1+\delta}$ and then treating δ as a small parameter. It is shown herethat the same approach gives excellent results when applied to difficultnonlinear differential equations such as the Lane–Emden, Thomas–Fermi,Blasius, and Duffing equations.

32849 Grassmann-valued fluid dynamics. Fatyga, B. W. (Physics Department, Indiana University, Bloomington, Indiana 47405(US)); Kostelecky, V. A.; Truax, D. R. *Journal of Mathematical Physics (New York) (USA),* 30(7): 1464-1472 (Jul 1989).

Certain systems of nonlinear partial differential equations can be writtenin a simple form as a single Grassmann-valued partial differential equation.Equations describing compressible fluid flow are of this type. A method forfinding soft solutions of the Grassmann-valued partial differential equationarising in this context is presented. The method is a generalization of theLagrangian-coordinates approach to the case of Grassmann variables. Generally,solutions obtained by this method have the form of infinite series, whoseexpansion yields new relations among the unknown variables. In some simplecases, the series can be summed. The equivalence of the Grassmann solutions tothe usual solutions is shown for these cases.

32850 A static cylindrically symmetric solution for perfect fluid in general relativity. Davidson, W. (Mathematics Department, University of Otago, Dunedin, New Zealand(GB)). *Journal of Mathematical Physics (New York) (USA),* 30(7): 1560-1561 (Jul 1989).

A solution of Einstein's equations for a stationary cylindrically symmetricperfect fluid is presented. The extent of the fluid is radially infinite but theproper density μ and pressure p are physically well behaved everywhere. Onthe axis μ and p are finite and positive. As the radial coordinate ρincreases μ and p decrease monotonically to zero at infinity. The ratio$p/\mu(<1)$ also steadily decreases. It is shown that the regularity conditionat the axis is satisfied. The solution is algebraically general of Petrov typeI.

32851 Model-based passive ranging. Candy, J. V. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550(US)); Sullivan, E. J. *Journal of the Acoustical Society of America (USA),* 85(6): 2472-2480 (Jun 1989).

Passive localization by use of acoustic propagation models, sometimes called"matched field processing" is usually carried out in three steps. First, someappropriate model is selected. Then, model parameters, usually taken fromarchival data or from auxiliary measurements, are introduced into the model.Finally, acoustic measurements of the field radiated by the source to be locatedare made that, in combination with the properly parametrized model, allow asolution for the source coordinates to be carried out. Here, such a model-basedapproach is used in conjunction with a normal-mode model. By coupling theprocedure with a parameter estimation/identification scheme and using ahorizontal (towed) array instead of the usual vertical array, it is shown thatthe model parameters need not be known *a priori* inorder to carry out the solution. This is in contrast to the standard approach inwhich the modal functions must be computed directly from the model (waveequation) in order to solve the problem. It is still necessary to base thecalculation on a model, but, surprisingly, the sound velocity profile, the oceandepth, and ocean bottom properties need not be known explicitly, sincesufficient information to determine the range of the source can be inferreddirectly from the measured data themselves. Using a sophisticated acousticpropagation model to generate simulated data, coupled with various arrayprocessing techniques, the feasibility of the approach is demonstrated.

32852 Fermat's principle and nonlinear traveltime tomography. Berryman, J. G. (Lawrence Livermore National Laboratory, P.O. Box 808 L-156, Livermore, California 94550(US)). *Physical Review Letters (USA),* 62(25): 2953-2956 (19 Jun 1989). DOE Contract W-7405-ENG-48.

Fermat's principle shows that a definite convex set of feasible slownessmodels, depending only on the traveltime data, exists for the fully nonlineartraveltime inversion problem. In a new iterative reconstruction algorithm, theminimum number of nonfeasible ray paths is used as a figure of merit todetermine the optimum size of the model correction at each step. The numericalresults show that the new algorithm is robust, stable, and produces very goodreconstructions even for high contrast materials where standard methods tend todiverge.

32853 Comment on "Resolution of causality violation in the classical radiation reaction". Goebel, C. J. (Department of Physics, University of Wisconsin, Madison, Wisconsin 53706(US)). *Physical Review Letters (USA),* 62(25): 3010-3010 (19 Jun 1989).

A Comment on the Letter by Valentini, Phys. Rev. Lett. 61,1903 (1988).

32854 Traversable wormholes: Some simple examples. Visser, M. (Theoretical Division, T-8, Mail Stop B-285, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)). *Physical Review [Section] D: Particles and Fields (USA),* 39(10): 3182-3184 (15 May 1989).

Building on the work of Morris, Thorne, and Yurtsever, some particularlysimple examples of traversable wormholes are exhibited. These examples arenotable both because the analysis is not limited to spherically symmetric casesand because it is possible to in some sense minimize the use of exotic matter.In particular, it is possible for a traveler to traverse such a wormholewithout passing through a region of exotic matter. As in previous analyses, theweak-energy condition is violated in these traversable wormholes.

32855 Determination of the onset of spatiotemporal complexity induced by soliton competition in a perturbed sine-Gordon chain. Ariyasu, J. C. (Theoretical Division and Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, New Mexico 87545(US)); Bishop, A. R. *Physical Review [Section] A: General Physics (USA),* 39(12): 6409-6415 (15 Jun 1989).

The competition between sine-Gordon-breather and kink-antikink-pairsolitons under the influence of damping and both ac and dc driving isinvestigated. We introduce soliton collective coordinates, and developequations of motion for this system. Then we analyze the transition bycalculating the perturbed separation of the stable and unstable orbits near thehomoclinic point of the motion using Melnikov's method. We find that thethreshold for complicated behavior is strongly dependent on the frequency ofthe ac driving, and that the contribution of the dc driving is to lower thisthreshold.

32856 Semiclassical structure of Hamiltonians. Feingold, M. (The James Franck Institute, The University of Chicago, Chicago, Illinois 60637(US)); Leitner, D. M.; Piro, O. *Physical Review [Section] A: General Physics (USA),* 39(12): 6507-6514 (15 Jun 1989). DOE Contract AC03-76SF00098.

The structure of few-body Hamiltonian matrices is studied in thesemiclassical regime. Given$(\hat{A_1}(\hat{q},\hat{p}),\hat{A_2}(\hat{q},\hat{p}))$, a pair of operators,it can be shown that, underquite general conditions, $\hat{A_2}$ takes the form of a banded matrixin the ordered eigenrepresentation of

$A^{\wedge}_1$. Moreover, thebandwidth depends only on $\hbar$ and certain generalized microcanonicalaverages. In particular, if $H=H_0+\epsilon V$, this implies that theperturbed Hamiltonian is banded in the appropriately ordered unperturbed basis.

32857 Random-walk simulation of diffusion-controlled processes among static traps. Lee, S. B. (Department of Mechanical and Aerospace Engineering, North Carolina State University, Raleigh, North Carolina 27695-7910(US)); Kim, I. C.; Miller, C. A.; Torquato, S. *Physical Review [Section] B: Condensed Matter (USA)*, 39(16): 11833-11839 (1 Jun 1989).

We present computer-simulation results for the trapping rate (rate constant) k associated with diffusion-controlled reactions among identical, static spherical traps distributed with an arbitrary degree of impenetrability using a Pearson random-walk algorithm. We specifically consider the penetrable-concentric-shell model in which each trap of diameter σ is composed of a mutually impenetrable core of diameter $\lambda\sigma$, encompassed by a perfectly penetrable shell of thickness $(1-\lambda)\sigma/2$: λ=0 corresponding to randomly centered or "fully penetrable" traps and λ=1 corresponding to totally impenetrable traps. Trapping rates are calculated accurately from the random-walk algorithm at the extreme limits of λ (λ=0 and 1) and at an intermediate value (λ=0.8), for a wide range of trap densities. Our simulation procedure has a relatively fast execution time. It is found that k increases with increasing impenetrability at fixed trap concentration. These "exact" data are compared with previous theories for the trapping rate. Although a good approximate theory exists for the fully-penetrable-trap case, there are no currently available theories that can provide good estimates of the trapping rate for a moderate to high density of traps with nonzero hard cores (λ>0).

32858 Quantum dynamics of a pulsed spin system: Long-time behavior of semiclassical wave functions. Nakamura, K. (The James Franck Institute, The University of Chicago, Chicago, Illinois 60637(JP)); Bishop, A. R.; Shudo, A. *Physical Review [Section] B: Condensed Matter (USA)*, 39(16): 12422-12425 (1 Jun 1989).

Semiclassical wave-function patterns in a pulsed spin system are examined in the post crossover-time regime. They show ergodic and nonergodic features possessed by the underlying classical dynamics. Local dimensions (i.e., singularities) of their probability density functions maintain enhanced fluctuations when the pulse strength lies in a transitional region leading to global chaos.

70 FUSION ENERGY

Refer also to citation(s) 30990, 31586

7001 Plasma Research

Refer also to citation(s) 30928, 31633, 31637, 31638, 31641, 31642, 31645, 31648, 31649, 31888, 32703, 32901, 32903, 32920, 32945

32859 (ACIESP–60(v.3), pp. 301-306) **Some applications of rf-fields to plasmas.** Sato, T. (Nagoya Univ. (Japan). Inst. of Plasma Physics); Watari, T. Academia de Ciencias do Estado de Sao Paulo, SP (Brazil). 1988. (CONF-8808156–: 6. Japan-Brazil symposium on science and technology, Sao Paulo, Brazil, 10-12 Aug 1988). In *Proceedings of the 6. Japan-Brazil Symposium on Science and Technology.* Order Number DE89612371/JAW. Available from NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS.

Some interesting radio-frequency applications in the ion cyclotron frequency range were carried out at the Institute of Plasma Physics, Nagoya University, Japan, are related. (M.C.K.).

32860 (CEA-CONF–9638) **Effect of pump limiter throat on pumping efficiency.** Ghendrih, P.; Grosman, A.; Samain, A.; Capes, H.; Morera, J.P. Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1988. 6p. (CONF-8804123–: International workshop on plasma edge theory in fusion devices, Augustusburg, German Democratic Republic, 26-30 Apr 1988). Order Number DE89770511/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The necessary control of plasma edge density has led to the development of pump limiters to achieve this task. On Tore Supra, where a large part of the program is devoted to plasma edge studies, two types of such density control apparatus have been implemented, a set of pump limiters and the pumps associated to the ergodic divertor (magnetically assisted pump limiters). Generally two different kinds of pump limiters can be used, those with a throat which drives the plasma from the open edge plasma (SOL) to the neutralizer plate, and those without or with a very short throat. We are interested here in this aspect of the pump limiter concept, i.e. on the throat effect on neutral density build-up in the vicinity of the pumping plates (and hence on pumping efficieny). The underlying idea of this throat effect can be readily understood; indeed while the neutral capture in pump limiters without throats is only a ballistic effect, on expects the plasma to improve the efficiency of pump-limiters via plasma-neutral-sidewall interactions in the throat. This problem has been studied both numerically and analytically. The paper is divided as follows. In section 2, we describe the basic features of pump-limiters which are modelized by the numerical code Cezanne. Section 3 is devoted to the throat length effect considering in particular the neutral density profile in the throat and the neutral density buil-up as a function of the throat lenght. In section 4, we show that the plugging effect occurs for reasonnable values of throat lengths. An analytical value of the plugging length is discussed and compared to the values obtained numerically.

32861 (CEA-CONF–9639) **Role of the pump limiter throat-ergodic divertor effect on edge plasma.** Grosman, A.; Samain, A.; Ghendrih, P.; Capes, H.; Morera, J.P. Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. 1988. 13p. (CONF-8805285–: 8. international Conference on plasma surface interactions, Juelich, Delaware, USA, 2-6 May 1988). Order Number DE89770510/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

A large part of the Tore Supra programme is devoted to plasma edge studies. Two types of such density control apparatus have been implemented, a set of pumps limiters and the ergodic divertor. The goal of the present paper is to investigate the effect of the pump limiter throat on pumping efficiency. We present also the possibilities of the ergodic divertor device to facilitate plasma pumping and power exhaust.

32862 (CONF-890403–19) **Magnetic fluctuations due to pressure driven instabilities in ATF.** Charlton, L.A.; Carreras, B.A.; Leboeuf, J.N.; Lynch, V.E. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international stellarator workshop; Oak Ridge, Tennessee, USA; 10-14 Apr 1989. Order Number DE89012337/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Advanced Toroidal Facility (ATF) was designed to have stable access to the second stability regime. For the design conditions, this should occur at beta values near $\beta_0 \approx 5\%$. In its initial phase of operation, the ATF plasma minor radius and the edge rotational transform, χ_a, were reduced by field errors, which have now been repaired. This reduction in radius and χ_a caused a large increase in the Shafranov shifts, and as a consequence a reduction in the beta value needed to access the second stability regime. From the low-n and high-n stability analysis using the experimentally measured profiles, the threshold to second stability was found to be as low as $\beta_0 \approx 1.0\%$. The beta values reached in the experiment, up to $\beta_0 \approx 3.0\%$, are well above this threshold value. The magnetic fluctuation measurements showed a reduction in the fluctuation level for $\beta_0 \geq 2\%$. In this paper, we discuss the results of simulations of the poloidal magnetic field fluctuations based on the resistive pressure-gradient-driven model. 8 refs., 2 figs.

32863 (CONF-890403–22) **Equilibrium and ideal stability studies for ATF.** Lynch, V.E.; Carreras, B.A.; Dominguez, N.; Leboeuf, J.N. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international stellarator workshop; Oak Ridge, Tennessee, USA; 10-14 Apr 1989. Order Number DE89012969/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper investigates the criterion for stability in the ATF torsatron. 4 refs., 3 figs.

32864 (DOE/ER/40465–T1) **Waves and instabilities in nonneutral plasmas.** Davidson, R.C. Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center. [1989]. 70p. Sponsored by DOD;DOE/ER. DOE Contract FG02-88ER40465. (CONF-8803133–1: Nonneutral plasma physics, Washington, D.C., USA, 28-29 Mar 1988). Order Number DE89012403/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This paper presents a survey of the equilibrium, stability and collective oscillation properties of magnetically-confined nonneutral plasmas. Emphasis is placed on summarizing several of the technical advances that have occurred in both theory and experiment since the early 1970's. 97 refs., 26 figs.

32865 (DOE/ER/53207–4) **Application of modern mathematical concepts to plasma confinement: Progress report.** Cary, J.R. Colorado Univ., Boulder, CO (USA). Dept. of Astrophysical, Planetary, and Atmospheric Sciences. Jun 1989. 11p. Sponsored by DOE Energy Research. DOE Contract FG02-85ER53207. Order Number DE89012952/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Progress in four research areas has been achieved. A second-order symplectic integration algorithm has been developed and tested. Use of this algorithm allows integration of systems of Hamiltonian equations of motion to be carried out with much less computation. Vacuum field optimization techniques have been improved. One result of this work is a simple method for calculating magnetic island widths. Studies of alpha particle transport in toroidal confinement systems were initiated. This has been used as a test bed for studies of symplectic integrators. Quantum modifications of separatrix crossing theory were calculated. In addition the principal investigator is organizing a US-Japan conference concerning the use of modern techniques for the study of plasma confinement. 14 refs.

32866 (DOE/ER/53252–13) **Use of zero and one dimensional RFP models to simulate behavior on ZT-40M and ZT-H: Quarterly progress report.** Klevans, E.H. Pennsylvania State Univ., University Park, PA (USA). 11 May 1989. 4p. Sponsored by DOE Energy Research. DOE Contract FG02-87ER53252. Order Number DE89012944/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses the following topics: preparation of a paper on the 0-D model of the reversed field pinch; 1-d impurity transport for a reversed field pinch; and 1-d neutral transport modelling. (LSP)

32867 (DOE/ET/53088–372) **Equilibrium of a plasma in the fluid- and Vlasov-Maxwell systems.** Mahajan, S.M.; Li, Wann-Quan. Texas Univ., Austin, TX (USA). Inst. for Fusion Studies. May 1989. 10p. Sponsored by DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–372). Order Number DE89013315/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

It is shown that a recently constructed exact solution of the Vlasov equation describing a plasma with density and temperature gradients can be expressed in terms of the constants of motion. The distribution function is then used to illustrate the differences between a Vlasov and a one fluid description. In fluid theory, only the pressure profile is determined (unless one postulates an equation of state), while the Vlasov description leads to a separate determination of density (g), and temperature (ψ^2) profiles; the equation of state, $g = \psi^{3-2/\beta}$, comes out naturally in the latter case. 3 refs.

32868 (ENEA-RT-FUS–88-9, pp. 13-19) **Lower hybrid heating in high density discharge in FT.** Alladio, F. (ENEA, Frascati (Italy). Centro Ricerche Energia); Barbato, E.; Bardotti, G. and others. ENEA, Rome (Italy). 1988. (CONF-881015–: 12. international conference on plasma physics and controlled nuclear fusion research, Nice, France, 12-19 Oct 1988). In *Contributions to the 12 th International Conference on plasma physics and controlled nuclear fusion research. Nice, 12-19 October 1988.* Order Number DE89609767/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This paper deals with the results of the experiment of plasma heating by 8 GHz LH waves carried out on the Frascati Tokamak. The main purpose of the experiment is the investigation of the possibility of heating a high density plasma with LH waves. The coupling properties of the 8 GHz LH waves to the plasma are very good. A power density as high as 10 KW/cm/sup 2/is routinely injected into the plasma with reflection coefficent of ~ 15%. In the explored range of densities no evidence of density limit has been observed. As far as the heating results are concerned a RF power of 200 kW has been injected in two target plasmas of different densities. At low density (n/sub e/=3.5x10/sup 13/cm/sup -/3) the observed phenomenology is very similar to the one observed in a previous experiment with 2.45 GHz. At higher density n/sub e/=10/sup 14/cm/sup -/3 well above the 2.45 GHz density limit, the RF power. On the other hand the analysis of electron cyclotron emission spectra shows that faster electrons, corresponding to less accessible values of n are suppressed more strongly than the slower ones as the density is increased. The results on accessibility and those on plasma heating indicate that also the inaccessible part of the spectrum contribute effectively to plasma heating.

32869 (EUR-CEA-FC–1349) **Study of magnetic field lines after perturbation of a toroidal field with magnetic surfaces.** Mercier, C. Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee. Oct 1988. 27p. (In French). Available from NTIS (US Sales Only), PC A03/MF A01.

It is shown that a perturbing magnetic field creates magnetic islands around rational rotational transformation surfaces (q/sub o/ rational) of a toroidal magnetic field. For fairly general perturbing fields, the value of q/sub i/on the axis of the created islands is calculated. This value is used to obtain the size of the island, measured by the value of the flux of the field through the island to the separation. It is thus possible to investigate the turbulence of the medium by calculating the interaction of two neighboring islands.

32870 (GA-A–19662) **High power ion Bernstein wave experiments on DIII-D.** Pinsker, R.I.; Mayberry, M.J.; Porkolab, M.; Prater, R. General Atomics, San Diego, CA (USA). May 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-8905120–12: 8. topical conference on radio frequency power in plasmas, Irvine, California, USA, 1-3 May 1989). Order Number DE89013308/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Previous tokamak experiments with Ion Bernstein Wave (IBW) heating have exhibited efficient central ion heating and associated improvement in particle confinement. The prospect of localized bulk ion heating, along with the prediction that coupling to the IBW should improve under edge conditions characteristic of H-mode plasmas, motivated the present IBW program on the DIII-D tokamak. The 30-60 MHz tunability of the modified 2.25 MW FMIT rf power supply permits consideration of many different heating scenarios; in which central ion heating at $3/2\Omega_H$ with a small He^4 minority ($3\Omega_{He^4}$) was observed. Therefore, the transmitter frequency was 38 MHz and the nominal central toroidal field was B_T = 1.8 T, which places the $3/2\Omega_H(3\Omega_{He^4})$ layer a few centimeters outboard of the magnetic axis, and the $2\Omega_H$ layer just behind the radiating element in the antenna, as is required theoretically for efficient coupling to the IBW. 8 refs., 3 figs

32871 (GA-A–19663) **60 MHz fast wave current drive experiments for DIII-D.** Mayberry, M.J.; Chiu, S.C.; Porkolab, M.; Chan, V.; Freeman, R.; Harvey, R.; Pinsker, R. General Atomics, San Diego, CA (USA). May 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-8905120–11: 8. topical conference on radio frequency power in plasmas, Irvine, California, USA, 1-3 May 1989). Order Number DE89013307/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Non-inductive current drive is an essential element of the ITER program because it enhances high fluence nuclear testing during the technology phase of operations. By using fast waves in the ion cyclotron range of frequencies (ICRF), current drive efficiencies comparable to lower-hybrid current drive can be obtained with good penetration of wave power to the high temperature plasma core. An

additional advantage of the low frequency scheme is its technological simplicity due to the present availability of efficient, multi-megawatt rf sources in the ICRF. The DIII-D facility provides an excellent opportunity to test the feasibility of the low frequency FWCD approach. By combining with high power (2 MW) ECH injection at 60 GHz, it should be possible to generate plasmas with central electron temperatures of $T_{e0} \simeq 4$ keV, and by operating at a reduced toroidal field (B = 1T) to increase the electron β, strong single-pass absorption ($\eta_{labs} \geq 0.3$) can be achieved. The availability of a wide port recess (1m toroidal by 0.5m poloidal) will enable a travelling wave spectrum to be launched with $N_{parallel} \simeq 5$–7 at 60 MHz, which should be optimum for strong electron interaction. The resulting current drive efficiency should be sufficiently high to demonstrate FWCD at the $\sim$ 0.25–0.5 MA level at moderate densities ($\bar{n} \simeq 1.3 \times 10^{19}$ m^{-3}) using the existing 2 MW ICRF transmitter. 7 refs., 5 figs.

32872 (INIS-BR–1458, pp. 249) **Plasma's electron temperature measurements in the TBR-1 Tokamak.** Vannucci, A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Oliveira, I.C. de; Nascimento, I.C. do; Sanada, E.K.; Galvao, R.M.O.; Andreia, K. Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

ELECTRON TEMPERATURE/hot plasma; ELECTRON TEMPERATURE/tbr tokamak; EMISSION SPECTRA; SURFACE BARRIER DETECTORS; X RADIATION

32873 (INIS-mf–4754(no.38)) **International bulletin on atomic and molecular data for fusion. No. 38.** Smith, J.J. (ed.). International Atomic Energy Agency, Vienna (Austria). Atomic and Molecular Data Unit. Jan 1989. 119p. Order Number DE89615525/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The Bulletin provides information on atomic and molecular data relevant for fusion research. In Part I the indexed papers are listed separately for structure and spectra, atomic and molecular collisions and surface interactions. Part II contains all the bibliographic data for both the indexed and non-indexed references (654 references). An author index is included.

32874 (IYaF–88-52) **Experiments on investigation of angular characteristics of power microsecond REB.** Voropaev, S.G.; Knyazev, B.A.; Kojdan, V.S.; Lebedev, S.V.; Chikunov, V.V.; Shcheglov, M.A. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 25p. (In Russian). Order Number DE89615530/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Results of experiments on measuring angular spread of microsecond REB by U-1 unit are presented. Measurements of beam spread were performed at anode output directly and after passing compression system by the beam. Presented results of measuring electron angular spread show, that its characteristic value behind lavsan anode foil of 10 μm thickness in the absence of beam compression system equals 6$\pm$1.5 deg. This angular spread is practically preserved during beam transport through compression system with M=20 plug ratio angular spread in the region of the maximal compression equals Θ=27$\pm$7 deg in this case. Conditions, under which the noticeable decrease of angular beam spread is observed, may occur in the diode at low pressure in compression chamber (p=10/sup -3/-10/sup -4/torr). 16 refs.; 12 figs.

32875 (IYaF–88-86) **Definition of adiabaticity of nonparaxial magnetic mirror.** Kuz'min, S.V. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 11p. (In Russian). Order Number DE89615531/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A possibility of numeric calculation of magnetic systems having no simple analytic descriptions is demonstrated taking nonparaxial magnetic mirror magnetic system as an example. Analytic specifications for adiabaticity boundaries of the earlier investigated magnetic systems of plane and round cusps are additionally obtained. 7 refs.; 5 figs.

32876 (IYaF–88-92) **Negative energy waves in magnetic flux tubes.** Ryutova, M.P. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 24p. Order Number DE89615526/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The properties of oscillation of a magnetic flux tube in the presence of a shear flow of matter along its axis have been studied. The presence of flows is shown to cause a number of new effects: the appearance of negative energy waves, reversal of the sign of radiative damping, the development of explosive instability at the nonlinear stage, and the development of "coarse" (linear) hydrodynamic instability when the velocity exceeds a certain threshold. The corresponding processes have been classified. The calcultions of the growth rates of dissipative instabilities associated with the radiation of sound waves and anomalous damping in the resonance layer have been performed. The conditions for the existence of explosive instability have been found. The results obtained can be of interest in connection with the problem of energy accumulation and release in the Solar atmosphere as well as for better insight into the dynamics of various processes in the space and laboratory plasma with the filamentary structure of magnetic field. 11 refs.

32877 (KIYI–88-6) **On theory of stability of flute modes in a tokamak with β/sub e/$\simeq$ 1.** Cheremnykh, O.K. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 17p. (In Russian). Order Number DE89615574/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Consideration is given to MHD stability of ballooning flute modes and Mersie modes at finite plasma pressure (β/sub Θ/$\simeq$ 1, β/sub Θ/ - ratio of plasma pressure to poloidal field pressure) in tokamak with near-circular magnetic surfaces and large aspect ratio. Analytical criteria of stability are obtained. It is established that considered disturbances can be stable at q or approx. 1 due to stabilizing influence of housing, where q - stability margin of tokamak. 7 refs.

32878 (KIYI–88-31) **Variation methods in the theory of the plasma bunches oscillations.** Repalov, I.N. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 28p. (In Russian). Order Number DE89615577/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The theoretical study of the natural and forced oscillations of the plasma bunches in the external electromagnetic fields was made. The canonical system of equations, similar with the ones of the multidimensional motion of the mass point has been obtained. By the use of this methodics the homogeneous and inhomogeneous oscillations of the spherical plasma cloat in the free space and magnetic field, the chains of plasma bunches as well as the natural and forced oscillations of the plasma cloat in the cylindrical resonator were studied. The problem of excitation of electromagnetic oscillations by the external source in the cylindrical resonator, loaded by the plasma bunch has been solved. 11 refs.; 6 figs.

32879 (KIYI–88-32) **Angular distribution of alpha particle flux on the first wall of a tokamak.** Goloborod'ko, V.Ya.; Yavorskij, V.A. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 14p. (In Russian). Order Number DE89615532/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The angular distribution of the ripple induced flux of high energy alpha particles on the first wall of the tokamak reactor is considered. It is shown that the wall loading is strongly peaked in poloidal angle (the peaking factor for the resonable parameters is about 10-15). The dependence of the alpha flux distribution on particle energy and tokamak parameters is weak. 9 refs.; 3 figs.

32880 (LAL–88-53) **Effect of the fringing field in sector bending magnets: the coupling of the transverse planes in the solutions of the equation of motion at second-order.** Roy, G. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Nov 1988. 11p. Order Number DE89776435/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Second order coupling terms for sector bending magnets due to edge effects at high energy are reviewed. Motion in the horizontal plane (bending plane) and in the vertical (nonbending) plane is considered. The model of Heaviside's function is outlined. The case of the complete bending magnet is treated. Three second order coupling terms between the vertical and horizontal planes in a complete

bending magnet are found. Their origin is the fringing field, i.e., the intensity difference of the magnetic field between the outside and the inside of the magnet.

32881 (PPPL–2609) **On the self-consistency of the principle of profile consistency results for sawtoothing tokamak discharges.** Arunasalam, V.; Bretz, N.L.; Efthimion, P.C.; Goldston, R.J.; Grek, B.; Johnson, D.W.; Murakami, M.; McGuire, K.; Rasmussen, D.A.; Stauffer, F.J. Princeton Univ., NJ (USA). Plasma Physics Lab. May 1989. 131p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89012914/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The principle of profile consistency states that for fixed limiter safety factor q_a, there exists unique natural equilibrium profile shapes for the current density j(r), and the electron temperature $T_e(r)$ for any tokamak plasma independent of the shapes of the heating power deposition profiles. The mathematical statement of the three basic consequences of this principle for sawtoothing discharges are: $(r_1/a) = F_1\ (1/q_a)$, $<T_e>/T_{eo} = F_2(1/q_a)$, and a unique scaling law for the central electron temperature T_{eo}, where r_1 is the sawtooth inversion radius and $<T_e>$ is the volume average T_e. Since for a given $T_e(r)$, the ohmic current j(r) can be deduced from Ohm's law, given the function F_1, the function F_2 is uniquely fixed and vice versa. Also given $F_1(1/q_a)$, the central current density $j_o = (V_L/2\pi bRZ_{eff})\ T_{eo}^{3/2} = (I_p/\pi a^2)\ F_3(q_a)$, where the function $F_3 = (q_a/q_o)$ is uniquely fixed by F_1. Here $b \approx 6.53 \times 10^3\ ln\Lambda$, and I_p, V_L, Z_{eff}, R, a, and q_o are the plasma current, loop voltage, effective ion charge, major and minor radius, and the central safety factor, respectively. Thus for a fixed j(r) or $T_e(r)$, the set of functions F_1, F_2, and F_3 is uniquely fixed. Further, the principle of profile consistency dictates that this set of functions F_1, F_2, and F_3 remain the same for all sawtoothing discharges in any tokamak regardless of its size, I_p, V_L, B_T, etc. Here, we present a rather complete and detailed theoretical examination of this self-consistency of the measured values of $T_e(r)$, F_1, F_2, and F_3 for sawtoothing TFTR discharges. 55 refs., 15 figs., 1 tab.

32882 (PPPL–2612) **Measurement of the poloidal magnetic field in the PBX-M tokamak using the motional Stark effect.** Levinton, F.M.; Fonck, R.J.; Gammel, G.M.; Kaita, R.; Kugel, H.W.; Powell, E.T.; Roberts, D.W. Princeton Univ., NJ (USA). Plasma Physics Lab. May 1989. 15p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89012830/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Polarimetry measurements of the Doppler-shifted H_α emission from a hydrogen neutral beam on the PBX-M tokamak have been employed in a novel technique for obtaining q(0) and poloidal magnetic field profiles. The electric field from the beam particle motion across the magnetic field ($E = V_{beam} \times B$) causes a wavelength splitting of several angstroms, and polarization of the emitted radiation (Stark effect). Viewed transverse to the fields, the emission is linearly polarized with the angle of polarization related to the direction of the magnetic field. 14 refs., 5 figs.

32883 (PPPL–2620) **The gBL transport equations.** Mynick, H.E. Princeton Univ., NJ (USA). Plasma Physics Lab. May 1989. 13p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89012828/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The transport equations arising from the "generalized Balescu-Lenard" (gBL) collision operator are obtained, and some of their properties examined. The equations contain neoclassical and turbulent transport as two special cases, having the same structure. The resultant theory offers potential explanation for a number of results not well understood, including the anomalous pinch, observed ratios of Q/IT on TFTR, and numerical reproduction of ASDEX profiles by a model for turbulent transport invoked without derivation, but by analogy to neoclassical theory. The general equations are specialized to consideration of a number of particular transport mechanisms of interest. 10 refs.

32884 (PPPL–2622) **Anisotropic distribution function of minority tail ions generated by strong ion-cyclotron resonance heating.** Chang, C.S.; Colestock, P. Princeton Univ., NJ (USA). Plasma Physics Lab. May 1989. 30p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89013121/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The highly anisotropic particle distribution function of minority tail ions driven by ion-cyclotron resonance heating at the fundamental harmonic is calculated in a two-dimensional velocity space. It is assumed that the heating is strong enough to drive most of the resonant ions above the in-electron critical slowing-down energy. Simple analytic expressions for the tail distribution are obtained fro the case when the Doppler effect is sufficiently large to flatten the sharp pitch angle dependence in the bounce averaged qualilinear heating coefficient, D_b, and for the case when D_b is assumed to be constant in pitch angle and energy. It is found that a simple constant-D_b solution can be used instead of the more complicated sharp-D_b solution for many analytic purposes. 4 refs., 4 figs.

32885 (PPPL–2624) **Propagation of a Gaussian beam in a nonhomogeneous plasma.** Mazzucato, E. Princeton Univ., NJ (USA). Plasma Physics Lab. Jun 1989. 19p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89013349/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The asymptotic theory of Choudhary and Felsen on the propagation of scalar inhomogeneous waves in two-dimensional isotropic media is extended to the case of three-dimensional vector fields. The theory is applied to the propagation of Gaussian beams in nonhomogeneous media. The wave trajectory equations are then reformulated for anisotropic media and used for tracking a Gaussian beam in a tokamak plasma. 14 refs., 5 figs.

32886 (UCRL–100577) **ECH on the MTX [Microwave Tokamak Experiment].** Stallard, B.W.; Byers, J.A.; Hooper, E.B.; Makowski, M.A.; Meassick, S.; Rice, B.W.; Rognlien, T.D.; Verboncoeur, J. Lawrence Livermore National Lab., CA (USA). Apr 1989. 4p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-8905120–8: 8. topical conference on radio frequency power in plasmas, Irvine, California, USA, 1-3 May 1989). Order Number DE89012330/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Microwave Tokamak Experiment (MTX) at LLNL is investigating the heating of high density Tokamak plasmas using an intense pulse FEL. Our first experiments, now beginning, will study the absorption and plasma heating of single FEL pulses (20 ns pulse length and peak power up to 2 GW) at a frequency of 140 GHz. A later phase of experiments also at 140 GHz will study FEL heating at 5 kHz rate for a pulse train up to 50 pulses (35 ns pulse length and peak power up to 4 GW). Future operations are planned at 250 GHz with an average power of 2 MW for a pulse train of 0.5 s. The microwave output of the FEL is transported quasi-optically to the tokamak through a window-less, evacuated pipe of 20 in. diameter, using a six mirror system. Computational modelling of the non-linear absorption for the MTX geometry predicts single-pass absorption of 40% at a density and temperature of $1.8 \times 10^{20} m^{-3}$ and 1 keV, respectively. To measure plasma microwave absorption and backscatter, diagnostics are available to measure forward and reflected power (parallel wire grid beam-splitter and mirror directional couplers) and power transmitted through the plasma (segmented calorimeter and waveguide detector). Other fast diagnostics include ECE, Thompson scattering, soft x-rays, and fast magnetic probes. 8 refs., 2 figs.

32887 Observation of parametric gain suppression in stimulated rotational Raman scattering over long air paths. Henesian, M.A. (Lawrence Livermore National Lab., Livermore, CA (US)); Pennington, D.M. v.v of Proceedings of the conference on lasers and electro-optics. Optical Society of America, Washington, DC (1988). (CONF-880402–: CLEO '88: OSA/IEEE conference on lasers and electro-optics, Anaheim, California, USA, 25-29 Apr 1988).

The authors report the first observation of parametric gain suppression of stimulated rotational Raman scattering (SRRS) in atmospheric N/sub 2/in propagation experiments over long air paths with a large-aperture large-Fresnel-number beam. They previously reported our observations of small-scale beam breakup in the near field and high-divergence speckle in the farfield in strong SRRS conditions. In their most recent data this speckle is absent in a far-field zone surrounding the forward direction and appears in a

narrow cone peaked at an angle of $\geq$300 μrad. They believe this is a manifestation of Raman gain suppression. Suppression of the exponential gain in stimulated Raman scattering in low-dispersion media by competition with four-wave parametric mixing of pump, Stokes, and anti-Stokes waves was first recognized by Shen and Bloembergen. When the anti-Stokes wave is phase matched for generation in the near-forward direction, excitation of an optical phonon wave is prevented by the upconversion of pump photons to anti-Stokes photons. Stimulated growth of the Stokes wave is thus suppressed because the phonon excitation is damped.

32888 Measurement of electron energy deposition necessary to form an anode plasma in Ta, Ti, and C for coaxial bremsstrahlung diodes. Sanford, T. W. L. (Sandia National Laboratories, Albuquerque, New Mexico 87185(US)); Halbleib, J. A.; Poukey, J. W.; Pregenzer, A. L.; Pate, R. C.; Heath, C. E.; Mock, R.; Mastin, G. A.; Ghiglia, D. C.; Roemer, T. J.; and others. *Journal of Applied Physics (USA),* 66(1): 10-22 (1 Jul 1989).

Measurements are made of surface doses necessary to initiate an anode plasmaby electron bombardment of Ta, Ti, and C anodes for coaxial geometriescharacteristic of high-power electron-beam diodes. Measured lower and upperbounds of doses necessary to form an anode plasma are 54±7–139±16 J/g inTa, 214±23–294±71 J/g in Ti, and 316±33–494±52 J/g in C. Withinthese bounds, probable values for the threshold are given under specificassumptions The measurements are consistent with a thermal desorption model forplasma formation.

32889 Tandem helium plasma spectrometry with a capacitively coupled discharge formed above a helium ICP. Chan, S. (Department of Chemistry, The George Washington University, Washington, D.C. 20052(US)); Tan, H.; Montaser, A. *Applied Spectroscopy (USA),* 43(1): 92-95 (Jan 1989).

A tandem helium plasma was formed by placing a water-cooled, groundedelectrode above a helium inductively coupled plasma (He ICP). The tandemplasma could be operated at 250 to 700 W. Detection limits of F, Cl, Br,S, and C at 500 W were comparable or superior to those from a He ICP operatedat 1500 W. At 500 W, the electron number density for the tandem heliumplasma was greater than that for the He ICP at 1500 W, but similar excitationtemperatures and roughly similar rotational temperatures were obtained.

32890 High-resolution bent-crystal spectrometer for the ultrasoft x-ray region. Beiersdorfer, P. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey 08543(US)); von Goeler, S.; Bitter, M.; Hill, K. W.; Hulse, R. A.; Walling, R. S. *Review of Scientific Instruments (USA),* 60(5): 895-906 (May 1989).

A multichannel vacuum Bragg-crystal spectrometer has been developed for high-resolution measurements of the line emission from tokamak plasmas in the wavelength region between 4 and 25 A. The spectrometer employs a bent crystal in Johann geometry and a microchannel-plate-intensified photodiode diode array. The instrument is capable of measuring high-resolution spectra ($\lambda/\Delta\lambda\approx$3000) with fast time resolution (4 ms per spectrum) and good spatial resolution (3 cm). The spectral bandwidth is $\Delta\lambda/\lambda_0$=15% at λ_0=8 A. A simple tilt mechanism allows access to different wavelength intervals. In order to illustrate the utility of the new spectrometer, time- and space-resolved measurements of the n=3–2 spectrum of selenium from the Princeton Large Torus tokamak plasmas are presented. The data are used to determine the plasma transport parameters and to infer the radial distribution of fluorinelike, neonlike, and sodiumlike ions of selenium in the plasma. The new ultrasoft x-ray spectrometer has thus enabled us to demonstrate the utility of high-resolution *L*-shell spectroscopy of neonlike ions as a fusion diagnostic.

32891 Anomalous transport arising from nonlinear resistive pressure-driven modes in a plasma. Hamaguchi, S. (Courant Institute of Mathematical Sciences, New York University, New York, New York 10012(US)). *Physics of Fluids B: Plasma Physics (USA),* 1(7): 1416-1430 (Jul 1989).

Anomalous transport caused by fluctuations of resistive pressure-drivenmodes is discussed within the framework of magnetohydrodynamics (MHD). Thenonlinear-reduced equations describing fluctuations localized near a particularmagnetic field line are derived for tokamak and reversed-field-pinch (RFP)plasmas, taking into account nonzero viscosity and heat conductivity. For anideally stable but resistively slightly unstable plasma, the anomalous transportis caused particularly by convective motions. The convection is studied asbifurcation from the linearly unstable equilibrium and the expression of theanomalous transport in a tokamak plasma is obtained as a function of the meanpressure gradient near the critical point. In order to evaluate the effects ofthe convection on the anomalous transport under various conditions, the reducedequations are also solved numerically. It is found that Nusselt number, that is,the ratio of the total heat conductivity including the anomalous heat transportto the classical collisional heat conductivity, is significantly large undersome conditions. This partially accounts for the large heat losses in controlledthermonuclear fusion devices.

32892 Particle confinement in realistic 3D rotamak equilibria. Bellan, P. M. (California Institute of Technology, Pasadena, California 91125(US)). *Physical Review Letters (USA),* 62(21): 2464-2467 (22 May 1989).

The rotating magnetic field b_ω of a rotamak tilts the effective flux surface seen by electrons (but not ions). Electrons are imperfectly confined to these tilted flux surfaces, but are energetically confined in a 3D potential well bounded by an untilted flux surface. When $eb_\omega/m_e\nu_{ei}\approx r_0/\delta_{skin}$ the tilt is minimized and the well depth corresponds to MHD pressure balance.

32893 Link between microstability and macrostability of plasmas. Litwin, C. (Department of Nuclear Engineering and Engineering Physics, University of Wisconsin, Madison, Wisconsin 53706(US)). *Physical Review Letters (USA),* 62(25): 2973-2976 (19 Jun 1989).

A mechanism linking high-frequency microinstabilities and the low-frequencymacrostability is proposed. The coupling is provided by the time-averagedforce, ponderomotive force, of unstable high-frequency waves. Two specificexamples of this phenomenon are discussed. It is shown that anα-particle loss-cone instability stabilizes the flute mode of anignited, axisymmetric mirror plasma. In tokamaks, the ion-whistler instability,driven by an anisotropic population of energetic particles, stabilizes theinternal kink mode for JET range of parameters.

32894 Onset of nonlinear saturation for Rayleigh-Taylor growth in the presence of a full spectrum of modes. Haan, S. W. (Lawrence Livermore National Laboratory, Livermore, California 94550(US)). *Physical Review [Section] A: General Physics (USA),* 39(11): 5812-5825 (1 Jun 1989). DOE Contract W-7405-ENG-48.

It is generally recognized that a single Rayleigh-Taylor unstable mode grows exponentially, proportional to the initial amplitude, until the amplitude is about 1/10 to 1/5 of the wavelength. The growth then becomes nonlinear, and the mode evolves into spikes and bubbles. This paper considers how this picture of the transition to nonlinearity changes when, instead of there being a single mode, there is a full spectrum of modes. We argue that nonlinear behavior begins whenever the sum of modes over a specified small region of k space becomes comparable to the wavelength. In the case of a single mode, this reduces to the usual comparison of the mode's amplitude with its wavelength λ. But if the modal amplitudes are smooth functions of k, the modes begin to saturate when their amplitude is comparable to λ^2/R times a dimensionless scale factor; here, R is the radius in spherical geometry, or the length of the surface in planar geometry. Given this new notion of the amplitude at which nonlinear saturation begins, we construct a simple model to estimate the net perturbation resulting from a broadband initial spectrum. We assume that modes grow exponentially until saturation occurs, and then the growth of the individual modes becomes linear in time. The model predictions in two and three dimensions are compared with Read and Young's experiments [Atomic Weapons Research Establishment Report No. 011/83, Aldermasten, 1983 (unpublished)], and to Youngs's calculations [Physica 12*D*, 32 (1984)]. The experimental results are used to set the single parameter characterizing the onset of nonlinearity. The model provides a complete description of a weak dependence on initial amplitude.

32895 Measurements of gain and line broadening in lithium-like aluminum. Moreno, J. C. (Laboratory for Plasma Research, University of Maryland, College Park, Maryland 20742(US)); Griem,

H. R.; Goldsmith, S.; Knauer, J. *Physical Review [Section] A: General Physics (USA),* 39(11): 6033-6036 (1 Jun 1989).

Spectroscopic measurements were made of lithiumlike Al emission lines from laser-produced plasmas. Flat targets, consisting of thin layers of Al coated on a Mylar backing, were irradiated with up to eight beams of the OMEGA laser system employing a line-focus configuration. The Al xi 4*f*-3*d* line at 154.7 A exhibited a gain coefficient of 4.1±1.2 cm^{-1} from comparisons of line intensities from 3- and 6-mm-long plasmas. Similarly, the 4*d*-3*p* line at 150.7 A and the 5*f*-3*d* line at 105.7 A had gain coefficients of 4.5±1.3 and 3.5±0.8 cm^{-1}, respectively. The linewidth of the 5*f*-3*d* line was measured to be 0.35 A, which is much larger than the expected Doppler and instrumental width and can be attributed to Stark broadening. This Stark broadening corresponds to an electron density of 3×10^{19} cm^{-3}.

32896 Measurements of laser plasma coronal conditions and thermal transport with time-resolved x-ray spectroscopy. Willi, O. (The Blackett Laboratory, Imperial College of Science and Technology, London, SW7 2BZ, United Kingdom(GB)); Tabatabaei, S. D.; Riley, D.; Hauer, A.; Delamater, N.; Chenais-Popovics, C.; Apte, P.; Cole, A. *Physical Review [Section] A: General Physics (USA),* 39(11): 6090-6093 (1 Jun 1989).

This paper presents a detailed characterization of the plasma conditions near the critical density of a laser-produced plasma. Solid spherical plastic targets with small aluminum tracer dots buried below overcoated plastic layers have been uniformly illuminated with green laser light at irradiances of 10^{14}–10^{15} W/cm^{-2}. Time-resolved temperature and density profiles were obtained by using x-ray emission spectroscopy. Detailed comparisons with hydrodynamic simulations show that the thermal transport is well characterized by a flux limit of 0.1.

7002 Fusion Power Plant Technology

Refer also to citation(s) 30618, 31617, 31624, 31747, 32862

32897 (CNIC–00160) **Study of computational method about equations for laser fusion with superthermal electron transport and its applications.** Zhang Yonghui and others. China Nuclear Information Centre, Beijing, BJ (China). Feb 1988. 8p. (In Chinese). (IAPCM–0009). Order Number DE89612438/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

This is an outline of a large code for computing superthermal electron transport in laser fusion plasmas. The code involves the computations of mass, momentum, electron temperature, ion temperature, photon temperature, numbers of superthermal electrons and thermal electrons, electric field, etc.. But the numerical methods for superthermal electrons are centrally considered in this paper. Especially the mapping from kinetic energy bins into total energy bins is adopted. The figures of numerical simulation conforming with the experimental results are also presented.

32898 (CONF-881031–70) **MHD flow in insulating circular ducts for fusion blankets.** Hua, T.Q.; Walker, J.S. Argonne National Lab., IL (USA). 1988. 7p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 8. topical meeting on technology of fusion energy; Salt Lake City, Utah, USA; 9-13 Oct 1988. Order Number DE89012425/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper treats steady laminar flows of liquid metals in electrically insulated circular ducts in the presence of strong, transverse nonuniform magnetic fields. The interaction parameter and Hartmann number are assumed to be large, whereas the magnetic Reynolds number is assumed to be small. This problem is of importance to MHD flows in fusion blankets especially when suitable insulating material is identified and developed for use in fusion reactor environments. Use of insulated duct could substantially reduce the MHD pressure drop and thus would simplify the design and enhance the performance of the liquid-metal-cooled blankets. 5 refs., 5 figs.

32899 (CONF-890403–23) **Wall conditioning in ATF [Advanced Toroidal Facility].** Langley, R.A.; Clark, T.L.; Glowienka, J.C.; Goulding, R.H.; Mioduszewski, P.K.; Rasmussen, D.A.; Rayburn, T.F.; Schaich, C.R.; Shepard, T.D.; Simpkins, J.E. Oak Ridge National Lab., TN (USA). 1989. 11p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international stellarator workshop; Oak Ridge, Tennessee, USA; 10-14 Apr 1989. Order Number DE89012970/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Techniques for cleaning and conditioning the vacuum vessel of the Advanced Toroidal Facility (ATF) and its internal components are described. The vacuum vessel cleaning technique combines baking to 150°C and glow discharges with hydrogen gas. Chromium gettering is used to further condition the system. The major internal components are the anodized aluminium baffles in the Thomson scattering system, a graphite-shielded ICRF antenna, two graphite limiters, and a diagnostic graphite plate. Three independent heating systems are used to bake some of the major components of the system. The major characteristics used for assessing cleanliness and conditioning progress are the maximum pressure attained during bakeout, the result of gas analysis, and relevant plasma parameters (e.g., time to radiative decay). Details of the various cleaning and conditioning procedures and results are presented. 5 refs., 8 figs., 3 tabs.

32900 (CONF-890403–24) **Simple method for calculating island widths.** Cary, J.R.; Hanson, J.D.; Carreras, B.A.; Lynch, V.E. Oak Ridge National Lab., TN (USA). 1989. 4p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 7. international stellarator workshop; Oak Ridge, Tennessee, USA; 10-14 Apr 1989. Order Number DE89013048/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A simple method for calculating magnetic island widths has been developed. This method uses only information obtained from integrating along the closed field line at the island center. Thus, this method is computationally less intensive than the usual method of producing surfaces of section of sufficient detail to locate and resolve the island separatrix. This method has been implemented numerically and used to analyze the buss work islands of ATF. In this case the method proves to be accurate to at least within 30%. 7 refs.

32901 (CONF-8905120–10) **ICRF Faraday shield plasma sheath physics: The Perkins paradigm.** Wheaton, J.H.; Ryan, P.M.; Raridon, R.J. Oak Ridge National Lab., TN (USA). 1989. 5p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 8. topical conference on radio frequency power in plasmas; Irvine, California, USA; 1-3 May 1989. Order Number DE89012362/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Using a 2-D nonlinear formulation which considers the plasma edge near a Faraday shield in a self consistent manner, progress is indicated in the modeling of the ion motion for a Perkins embodiment. Ambiguities in the formulation are also indicated, the resolution of which will provide significant insight into the impurities generation for ICRH antennas. 6 refs., 3 figs.

32902 (CTH-IEFT-PP–1987-19) **Calculation of triton confinement and burn-up in tokamaks.** Anderson, D.; Battistoni, P. Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. 1987. 23p. Order Number DE89615584/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

An analytical investigation is made of the confinement and subsequent burn-up of fusion produced tritons in a deuterium Tokamak plasma. Explicit approximations are obtained for the triton confinement factor, clearly displaying the scaling with physical parameters. The importance of pitch angle scattering losses during the triton slowing down is also estimated. A comparison with experiments and numerical calculations on the FT Tokamak slows good qualitative agreement. (authors).

32903 (DOE/ET/53082–1) **Torsatron/stellarator research at the University of Wisconsin-Madison, 1983.** Wisconsin Univ., Madison, WI (USA). Torsatron/Stellarator Lab. 1983. 223p. Sponsored by DOE Energy Research. DOE Contract AC02-78ET53082. Order Number DE89013225/JAW. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

This report details experimental activities of the University of Wisconsin-Madison Torsatron/Stellarator Laboratory during the period 1978 through 1983. Experiments on the Proto-Cleo Stellarator have demonstrated the effectiveness of ion-cyclotron resonance heating with ion temperatures increased to 150 eV. Tangential injection of gun-produced plasmas showed a reduction in convective cell structures with an increase in confinement time of a factor of two. Pfirsch-Schluter currents were measured to be in excellent agreement with neoclassical predictions. Studies on the Proto-Cleo Torsatron identified the presence of drift waves and rippling modes and identified a runaway instability under certain operating conditions. Heat pulse propagation measurement were used to obtain transport coefficients. Electron-cyclotron resonance heating was observed with good agreement to a stochastic heating model related to local field gradients. During this period, the Interchangeable Module Stellarator (IMS) was designed and fabricated. IMS is the first modular stellarator to be built based upon the modular coil concept of Rehker and Wobig. Details of the design and construction are presented. Initial operation of IMS demonstrated well formed vacuum magnetic surfaces with no evidence of significant isolation. Experience gained in the design of IMS was utilized in a modular stellarator reactor study. UWTOR-M, to demonstrate the feasibility of stellarator reactors based upon this concept.

32904 (ECN–214) **EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987.** Flipot, A.J.; Kennedy, P.; Conrad, R.; Kwast, H. Netherlands Energy Research Foundation, Petten (Netherlands). Mar 1989. 69p. Order Number DE89615590/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

As part of the joint European Programme on fusion blanket technology three laboratories, Northern Research Laboratories (NRL), Springfields in the UK, SCK/CEN-Mol in Belgium and ECN-Petten in conjunction with JRC-Petten in the Netherlands have worked closely together since 1983 on the development of ceramic breeder materials, the programme being codenamed EXOTIC. Lithium oxides, aluminates, silicates and zirconates have been produced, characterised and irradiated in the HFR-Petten in experiments EXOTIC-1, -2 and -3. EXOTIC-4 is in preparation. In this fourth annual progress report the work achieved in 1987 is reported. For EXOTIC-1 to -3 mainly post irradiation examinations have been carried out like: visual inspection, puncturing of closed capsules, tritium retention measurements and material characterisation. Moreover, tritium release experiments on small specimens have started. SCK/CEN performed a general study on lithium silicates, in particular on the thermal stability. Finally, the fabrication and the characterisation of the materials to be irradiated in experiment EXOTIC-4 are presented. The eight capsules of EXOTIC-4 will be loaed with samples of Li/sub 2/SiO/sub 3/, Li/sub 2/O, Li/sub 2/ZrO/sub 3/, Li/sub 6/Zr/sub 2/O/sub 7/and Li/sub 8/ZrO/sub 6/. The irradiation will last 4 reactor cycles or about 100, Full Power Day, FPD. The main objective is to determine the tritium residence time of the various lithium zirconates. 18 figs., 8 refs., 15 tabs.

32905 (ENEA-RT-FUS–88-10) **Contributions to the 12th. international Cryogenic Engineering Conference. Southampton, 12-15 July 1988.** Anon. ENEA, Rome (Italy). 1988. 15p. Order Number DE89612427/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report consists of two papers read at the 12 th International Cryogenic Engineering Conference Held in Southampton from 12 to 15 July 1988. The first deals with the design of a conductor for NET machine; the second one gives the description of the liquid Nitrogen cooling system of the FTU tokamak.

32906 (ENEA-RT-FUS–88-10, pp. 11-15) **Liquid nitrogen cooling system for FTU Tokamak machine.** Migliori, S. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Bettinali, L.; Gasparotto, M.; Pizzuto, A. ENEA, Rome (Italy). 1988. (CONF-880736–: 12. international cryogenic engineering conference and exhibition, Southampton, UK, 12-15 Jul 1988). In *Contributions to the 12th. International Cryogenic Engineering Conference. Southampton, 12-15 July 1988.* Order Number DE89612427/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The basic idea in the design of the FTU (Frascati Tokamak Upgrade) machine is to try to reach a range of plasma parameters of great thermonuclear interest within a reasonable financial effort. In Ftu, the good energy confinement properties of a compact tokamak with a medium high toroidal field: 8 T, are combined with the strong plasma heating obtained injecting up to 8 MW of radiofrequency power in the lower hybrid "electron mode" (8 GHz). The main parameters of the machine is provided by the monolithic toroidal magnet supporting the vacum chamber and the poloidal fiels windings. The machine is kept, during operation, at liquid nitrogen temperature: -196 degres, to minimize the power consumption in the magnet coils and the poloidal field windings and to take advantage of the higher mechanical properties of thestructural materials (stainless steel and copper) at cryogenic temperature.

32907 (ENEA-RT-FUS–88-11) **2-D fluid dynamics models for laser driven fusion on IBM 3090 vector multiprocessors.** Atzeni, S. ENEA, Rome (Italy). 1988. 53p. (CONF-8807164–: IBM Europe Summer Istitute on advanced computering on the IBM 3090, Oberlech, Austria, 4-8 Jul 1988). Order Number DE89609811/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Fluid-dynamics codes for laser fusion are complex research codes, consisting of many distinct modules and embodying a variety of numerical methods. They are therefore good candidates for testing general purpose advanced computer architectures and the related software. In this paper, after a brief outline of the basic concepts of laser fusion, the implementation of the 2-D laser fusion fluid code DUED on the IBM 3090 VF vector multiprocessors is discussed. Emphasis is put on parallelization, performed by means of IBM Parallel FORTRAN (PF). It is shown how different modules have been optimized by using different features of PF: (i) modules based on depth-2 nested loops exploit automatic parallelization; (ii) laser light ray tracing is partitioned by scheduling parallel ICCG algorithm (executed in parallel by appropiately synchronized parallel subroutines). Performance results are given for separate modules of the code, as well as for typical complete runs.

32908 (ENEA-RT-FUS–88-14, pp. 5-9) **Engineering features, assembly equipment and installation procedures of the FTU machine.** Andreani, R. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Cecchini, A.; Gasparotto, M.; Pizzuto, A. ENEA, Rome (Italy). 1988. (CONF-880929–: 15. symposium on fusion technology, Utrecht, Netherlands, 19-23 Sep 1988). In *Contributions to the 15.th Symposium on Fusion technology. Utrecht 19-23 Sep 1988.* Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The basic idea in the design of the FTU (Frascati Tokamak Upgrade) machine is to try to reach a range of plasma parameters of great thermonuclear interest within a resonable financial effort. In FTU, the good energy confinement properties are combined with the strong plasma heating obtained injecting up to 8 MW of radiofrequency power in the lower hybrid electron mode (8 GHz). The main enginneering features of the toroidal machine, the remote handling tools for cutting and welding the vacuum vessel and the machine assembly and installation procedures are illustrated.

32909 (ENEA-RT-FUS–88-14, pp. 21-25) **3-D Montecarlo analysis of the NET shielding system.** Gallina, M. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Petrizzi, L.; Rado, V. ENEA, Rome (Italy). 1988. (CONF-880929–: 15. symposium on fusion technology, Utrecht, Netherlands, 19-23 Sep 1988). In *Contributions to the 15.th Symposium on Fusion technology. Utrecht 19-23 Sep 1988.* Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Within the frame of the European Task on shielding design studies a detailed 3-D neutronicanalysis has been carried out for the net configuration using the MCNP Monte Carlo code. The analysis has been mainly oriented to acces the shielding performances related to the radiation limits on the superconducting coils. An overall charachterization of the neutron and photon field in the whole system has also been done. Typical selected results are reported in this paper.

32910 (ENEA-RT-FUS–88-14, pp. 33-37) **Helium cooled ceramic breeder in tube blanket for a Tokamak reactor.** Anzidei, L. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Gallina, M.; Petrizzi, L.; Rado, V.; Simbolotti, G.; Zampaglione, V.; Violante, V.; Bassani, S. ENEA, Rome (Italy). 1988. (CONF-880929–: 15. symposium on fusion technology, Utrecht,

Netherlands, 19-23 Sep 1988). In *Contributions to the 15.th Symposium on Fusion technology. Utrecht 19-23 Sep 1988.* Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The paper presents the results of thwe 3-D stess analysis and neutronics of the helium-cooled ceramic breeder coaxial poloidal modules blanket for a tokamak reactor. The blanket modules from a compliant structure with acceptable values of the thermomechanical stresses. A 3-D value of the tritium breeding ratio of 1.22 has been calculated.

32911 (ENEA-RT-FUS–88-14, pp. 17-20) **Construction and test results of the FTU toroidal magnet.** Pizzuto, A. (Associazione EURATOM-ENEA sulla fusione, Frascati (Italy)); Cecchini, A.; Migliori, S.; Gasparotto, M.; Dal Mut, G.; Maragliano, A. ENEA, Rome (Italy). 1988. (CONF-880929–: 15. symposium on fusion technology, Utrecht, Netherlands, 19-23 Sep 1988). In *Contributions to the 15.th Symposium on Fusion technology. Utrecht 19-23 Sep 1988.* Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The FTU toroidal magnet was constructed by ANSALDO in Genova. This paper illustrates the procedures adopted during the main manufacturing phases when particular care had to be taken to realize a component capable of the performance axpected.

32912 (ENEA-RT-FUS–88-14, pp. 39-43) **New design for the coupling structures in FTU. Technological problems.** Ferro, C. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Orsini, A.; Sacchetti, M. ENEA, Rome (Italy). 1988. (CONF-880929–: 15. symposium on fusion technology, Utrecht, Netherlands, 19-23 Sep 1988). In *Contributions to the 15.th Symposium on Fusion technology. Utrecht 19-23 Sep 1988.* Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The design of the RF launching structures to be inserted in FTU has been fully reviewed with respect to the concept realized in FT. The technological problems concerning the dielectric windows and the separation between vacuum and atmosphere are described and discussed.

32913 (ENEA-RT-FUS–88-14, pp. 27-31) **First wall for NET. Engineering studies, mock up design and manufacturing.** Franconi, E. (Associazione EURATOM-ENEA sulla Fusione, Frascati (Italy)); Rado, V.; Simbolotti, G.; Violante, V.; Zampaglione, V.; Celentano, F.; Avanzini, P.G.; Brossa, M.; Casali, D.; Grattarola, M. ENEA, Rome (Italy). 1988. (CONF-880929–: 15. symposium on fusion technology, Utrecht, Netherlands, 19-23 Sep 1988). In *Contributions to the 15.th Symposium on Fusion technology. Utrecht 19-23 Sep 1988.* Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In collaboration with ANSALDO and within the frame of the European Fusion Tecnology Task N1 (Plasma Facing Components Design Studies), ENEA has performed a design an manufacturing feasibility study for the first wall of the Next European Torus (NET) during its "physics" operation phase. The main design specifications are average neutron wall load=1 MW/m/sup 2/, peak surface heat flux=0.4 MW/m/sup 2/, total number of burn pulses=1*10/sup 4/, average burn pulse duration=100 s, average neutron fluence=0.03 MWy/m/sup 2/, structure material=AISI 316L SA, coolant=H/sub 2/O at 50/100 centigrates (in/out). The reference ENEA-ANSALDO design is based on the use of flat plates coupled by microbrazing to poloidal cooling tubes. The technological development work has led to the design and manufacturing of a representative NET first wall box segment (0.65x 0.25x0.15 m) mockup which will be tested in the 190 kW Thermal Fatique Test Facility at JRC-Ispra. In this paper, we report on the various aspects of the basic experimental and theoretical investigations on the plasma-wall interactions for adequate protection of the first wall against erosion, global stress analysis of the first wall box, thecnological tests on brazed joints, and disign and manufacturing of the first wall mockup.

32914 (ENEA-RT-TIB–88-29, pp. 5-13) **Free electron lasers. Status and perspectives.** Renieri, A. (ENEA, Frascati (Italy). Centro Ricerche Energia). ENEA, Rome (Italy). 1988. (CONF-8806347–: 1. conference on new laser technologies and applications, Olympia, USA, 19-23 Jun 1988). In *Contributions to the 1st Int. Conference on new laser technologies and applications. Olympia, 19-23 Jun 1988.* Order Number DE89609812/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The status and the perspectives of a new and promising laser source, the free electron laser (FEL), is presented. The main problems connected with the operation of this kind of device are discussed, together with the potential fields of application.

32915 (HEDL-SA–3698) **Effects of fast neutron irradiation on thermal conductivity of Li_2O and $LiAlO_2$.** Ethridge, J.L.; Baker, D.E. Hanford Engineering Development Lab., Richland, WA (USA). Mar 1987. 25p. Sponsored by DOE Nuclear Energy. DOE Contract AC06-76FF02170. (CONF-870422–12: 89. annual meeting of the American Ceramic Society, Pittsburgh, Pennsylvania, USA, 26-30 Apr 1987). Order Number DE89011851/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Li_2O and $LiAlO_2$ are two candidates for solid breeder materials in the United States' Fusion Power Program. Critical to breeder design efforts are thermophysical data, the bulk of which have only recently become available, for unirradiated lithium ceramics. This paper expands the current limited database by presenting thermal conductivity data between 373-1173K for both materials following fast neutron irradiation. Samples were irradiated at 773-1173K to lithium burnups $\leq 11.5 \times 10^{20}$ captures/cm^3. Comparisons are made between these data and those from unirradiated archive samples of these same materials. 15 refs., 10 figs., 2 tabs.

32916 (INIS-BR–1458, pp. 235) **Radiation versus transport losses in fusion devices.** Engelhardt, W.E. (JET Joint Undertaking (UK)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

THERMONUCLEAR DEVICES/confinement; THERMONUCLEAR DEVICES/steady-state conditions; THERMONUCLEAR DEVICES/toroidal configuration; ENERGY LOSSES; CONFINEMENT; WALL EFFECTS

32917 (INIS-BR–1458, pp. 236) **Safety and environmental aspect of fusion.** Fujii-e, Y. (Tokyo Inst. of Tech. (Japan)). Sao Paulo Univ., SP (Brazil). 1988. (CONF-881020–: 4. international symposium on radiation physics, Sao Paulo, Brazil, 3-7 Oct 1988). In *Proceedings of the 4. International Symposium on Radiation Physics - Abstracts.* Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

THERMONUCLEAR POWER PLANTS/environmental impacts; THERMONUCLEAR POWER PLANTS/safety; SAFETY

32918 (IYaF–88-7) **Negative ion production in pure-hydrogen discharges of surface plasma.** Bel'chenko, Yu.I.; Kupriyanov, A.S. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 12p. (In Russian). Order Number DE89615599/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Experiments on H/sup -/ion extraction from multi-aperture surface-plasma sources (SPS) with large emitting surface were conducted for the purpose of full-scale test of SPS operation efficiency. Investigation of pure-hydrogen discharges of surface-plasma sources showed, that emission current density of H/sup -/ions was proportional to discharge current and achieved 1.1 A/cm/sup 2/at average current density of discharge on cathode, equal to 60 A/cm/sup 2/. H/sup -/beam of above 1 A intensity was produced from pure-hydrogen SPS under pulsed conditions; H/sup -/ion beam was equal to 0.15 A at 90 A discharge current under quasistationary long pulse conditions. 18 refs.; 5 figs.

32919 (IYaF–88-14) **Negative ion surface-plasma source for plasma trap injectors development in Novosibirsk.** Bel'chenko, Yu.I.; Dimov, G.I.; Dudnikov, V.G.; Kupriyanov, A.S. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 26p. (In Russian). Order Number DE89615598/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The works on high-current negative ion sources are presented. The investigations on pure plasma planotron and pure surface secondary emission systems of H/sup -/generation, which preceded the surface-plasma concept are described. The physical basis of the surface-plasma method of negative ion production is considered.

The versions and operating characteristics of different surface-plasma sources, including the multiampere (>or approx. 10 A) source are discussed. The studying of efficient large area (~ 10/sup 2/cm/sup 2/) negative ion surface-plasma emitters is described. The long-pulsed multiaperture surface-plasma generators with a current of about 1 A are described. 38 refs.; 17 figs.

32920 (IYaF–88-74) **Effect of magnetic system errors on the transport processes in long solenoids.** Kotel'nikov, I.A. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 25p. (In Russian). Order Number DE89615593/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The equilibrium of plasma and the transverse transport in the solenoidal cell of the axisymmetric open traps is investigated. The shape of magnetic surfaces in plasma with arbitrary large β ratio is found. The classification of possible regimes of nonclassical and resonant transport is given. The transport coefficients are evaluated and the magnetic field errors limitations providing guarantee that the transport is not greater then the classical one are pointed out. 3 refs.; 2 figs.

32921 (IYaF–88-76) **100-kJ microsecond REB transport in a one-meter solenoid.** Knyazev, B.A.; Mel'nikov, P.I.; Chikunov, V.V. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 24p. (In Russian). Order Number DE89615601/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Experiments on high-power electron beam transport through a gas along the strong magnetic field. A 1.1 MeV have been conducted 70 kA, 5 μs beam can be produced in a planar vacuum diode of U-1 accelerator (the initial total energy of the beam is 140 kJ and current density up to 0.2 kA/cm/sup 2/). The beam injected through a thin anode foil is focused in a converging magnetic field and after 20-fold compression (magnetic field in the mirror is 8.8 T) propogates in a 1-meter solenoid with B/sub s/=4 T. The beam transport has been investigated in the 10/sup -8/-1 Torr pressure regime. The transport of the macroscopically uniform REB with 110 kJ content and current density up to 2 kA/cm/sup 2/has been carried out. 25 refs.; 9 figs.

32922 (KFK–4528) **Mechanical properties of lithium silicates for fusion reactor breeder blankets.** Zimmermann, H. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion. Apr 1989. 32p. (In German). Order Number DE89774749/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

Lithium based oxide compounds are considered as tritium breeding materials in fusion reactors. Among other things dimensional stability during operating conditions are required. A compilation of the available data of the mechanical properties of Li/sub 4/SiO/sub 4/and Li/sub 2/SiO/sub 3/is presented. Young's modulus, compressive and flexural strength, and data of thermal shock and creep behaviour measured at KfK/IMF, ANL and other laboratories are compared. Parameter correlations for the properties data are presented.

32923 (LA–11519-MS) **Design and performance of the 10-kV, 5-MA pulsed-power system for the FRX-C compression experiment.** Rej, D.J.; Barnes, G.A.; Gribble, R.J.; Hinckley, J.E.; Kreider, T.W.; Waganaar, W.J. Los Alamos National Lab., NM (USA). May 1989. 32p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE89012803/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The design and performance of the pulsed-power system for the FRX-C compact toroid compression heating experiment are reviewed. Two inductively-isolated, 10-kV capacitor banks (total energy = 1.5 MJ) are discharged through a common, low-inductance load. The 5-MA currents are switched and crowbarred with parallel arrays of size-D ignitrons. Power supplies are constructed in simple 25 and 50 kJ modules, each capable of supplying 100 kA at 10 kV. Non-negligible source inductance and the addition of high-power resistors maintain module isolation and protect the system during fault modes. 21 refs., 31 figs.

32924 (LBL–25984) **Concepts, features, and design of a sixteen-to-four beam combiner for ILSE [Induction Linac Systems Experiment].** Judd, D.L.; Celata, C.; Close, E.; Faltens, A.; Hahn, K.; La Mon, K.; Lee, E.P.; Smith, L.; Thur, W. Lawrence Berkeley Lab., CA (USA). Mar 1989. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-890335–178: 13. particle accelerator conference, Chicago, Illinois, USA, 20-23 Mar 1989). Order Number DE89012743/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Sixteen intense parallel ion beams are to be transversely combined into four by dispersionless double bends. Emittance growth due to electrostatic energy redistribution and to the geometry is evaluated. Most bending elements are electric, and alternate with AG electrostatic quadrupoles similar to those upstream. The final elements are magnetic, combining focusing and "unbending". Electrode shapes and pulsed-current arrays (having very small clearances), and mechanical and electric features of the combiner, and described. 1 ref., 7 figs.

32925 (LBL–27219) **HIF/HIFAR accomplishments: A synopsis (December 1988).** Keefe, D. Lawrence Berkeley Lab., CA (USA). Dec 1988. 3p. Sponsored by DOE Energy Research. DOE Contract AC03-76SF00098. (HIFAN–416). Order Number DE89013352/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The goal of the HIFAR program is to build a physics and technology data base for high-current introduction linacs using multiple ion beams and current amplification. A central issue is maintaining a low enough 6-D emittance to allow focussing to a small focal spot. High current sources of heavy ions have more than adequate brightness; the single-beam transport experiment established linac transport limits; the multiple-beam experiment amplifies current in four beams; high-voltage injector for 16 beams; the induction linac systems experiment will test many driver features; and the heavy-ion fusion systems assessment gave encouraging results. 7 figs.

32926 (NRL-MR–6453) **Efficient second harmonic conversion of broadband high-peak-power Nd:glass laser radiation using large-aperture KDP crystals in quadrature.** Pronko, M.; Lehmberg, R.; Obenschain, S.; Pawley, C.; Manka, C.; Eckardt, R. Stanford Univ., CA (USA). W.W. Hansen Labs. of Physics. 23 Jun 1989. 39p. Sponsored by DOE Defense Programs. DOE Contract AI03-79DP40092. Order Number DE89012961/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have investigated the second harmonic conversion efficiency of broadband Nd:glass laser light ($\Delta\nu/c < 30$ cm^{-1} FWHM). Using two KDP crystals in a quadrature arrangement we obtained energy conversion efficiencies ~55% with an initial bandwidth for the fundamental of $\Delta\nu/c$ ~17 cm^{-1} FWHM. For these conditions, we observed a modest increase (~70%) in the harmonic bandwidth (FWHM) relative to the fundamental. The usual theory of three-wave mixing in dispersive birefringent nonlinear crystals is extended to describe the broadband harmonic conversion process; the generalized theory includes the statistical properties of the light and phase mismatch effects on the spectral components in the complex field amplitudes. Good agreement is shown between the code calculations and the measurements. 34 refs., 15 figs.

32927 (PNL-SA–16869) **Fabrication of lithium ceramic pellets, rings and single crystals for irradiation in BEATRIX-II.** Slagle, O.D.; Noda, K.; Takahashi, T. Pacific Northwest Lab., Richland, WA (USA). Apr 1989. 20p. Sponsored by DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-8904215–1: Symposium on fabrication and properties of lithium ceramics, Indianapolis, Indiana, USA, 24-26 Apr 1989). Order Number DE89011836/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

BEATRIX-II is an IEA sponsored experiment of lithium ceramic solid breeder materials in the FFTF/MOTA. Li_2O solid pellets and annular ring specimens were fabricated for in-situ tritium release tests. In addition, a series of single crystal and polycrystalline lithium ceramic samples were fabricated to determine the irradiation behavior and beryllium compatibility. 6 refs., 10 figs., 4 tabs.

32928 (PPPL–2621) **TFTR [Tokamak Fusion Test Reactor] neutral beam injected power measurement.** Kamperschroer, J.H.;

Grisham, L.R.; Dudek, L.E.; Gammel, G.M.; Johnson, G.A.; Kugel, H.W.; Lagin, L.; O'Connor, T.E.; Shah, P.A.; Sichta, P. Princeton Univ., NJ (USA). Plasma Physics Lab. May 1989. 28p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE89013350/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Energy flow within TFTR neutral beamlines is measured with a waterfall calorimetry system capable of simultaneously measuring the energy deposited within four heating beamlines (three ion sources each), or of measuring the energy deposited in a separate neutral beam test stand. Of the energy extracted from the ion source in the well instrumented test stand, 99.5 $\pm$ 3.5% can be accounted for. When the ion deflection magnet is energized, however, 6.5% of the extracted energy is lost. This loss is attributed to a spray of devious particles onto unmonitored surfaces. A 30% discrepancy is also observed between energy measurements on the internal beamline calorimeter and energy measurements on a calorimeter located in the test stand target chamber. Particle reflection from the flat plate calorimeter in the target chamber, which the incident beam strikes at a near-grazing angle of 12°, is the primary loss of this energy. A slight improvement in energy accountability is observed as the beam pulse length is increased. This improvement is attributed to systematic error in the sensitivity of the energy measurement to small fluctuations on the supply water temperature. An overall accuracy of 15% is estimated for the total power injected into TFTR. Contributions to this error are uncertainties in the beam neutralization efficiency, reionization and beam scrape-off in the drift duct, and fluctuations in the temperature of the supply water. 28 refs., 9 figs., 1 tab.

32929 (SAND–88-2057) **Thermophysical properties of advanced carbon materials for Tokamak limiters.** Roth, E.P.; Watson, R.D.; Moss, M.; Drotning, W.D. Sandia National Labs., Albuquerque, NM (USA). Apr 1989. 143p. Sponsored by DOE Energy Research. DOE Contract AC04-76DP00789. Order Number DE89012799/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

A plasma limiter is used to control the plasma size in Tokamak fusion research devices and serves as the primary area of plasma wall interaction. Contact with the plasma produces very high heat fluxes, typically 500–5000 W/cm^2 for pulse lengths of 1–10 seconds. Wall temperatures can reach as high as 3000 K resulting in significant melting or wall erosion. Graphite and graphite composites have been chosen as the materials that best meet the requirements of this severe environment. Measurement of the thermophysical properties of these materials is critical to the modeling of the thermal response of the limiters during operation. The thermal diffusivities, thermal conductivities and thermal expansions of several candidate materials were measured. The categories of materials investigated in this study were pyrolytic graphite and annealed pyrolytic graphite; fine-grained graphites; anisotropic carbon/carbon fiber composites; two-directionally woven fibers with a graphitized pitch matrix; and carbon/carbon fiber composites with a four-directionally woven carbon fiber wave. The thermal conductivities of the carbon/carbon fiber composites were determined as a function of fiber orientation. Conductivities were measured using both the laser flash diffusivity technique and the thermal comparative method. The advantages and disadvantages of each of these methods are discussed and the data compared. In addition, thermal expansion was measured as a function of fiber orientation using pushrod dilatometry techniques. 34 refs., 50 figs., 5 tabs.

32930 (SAND–89-0031C) **Performance of the Hermes-III gamma ray simulator.** Ramirez, J.J.; Prestwich, K.R.; Johnson, D.L.; Corley, J.P.; Denison, G.J.; Alexander, J.A.; Franklin, T.L.; Pankuch, P.J.; Sanford, T.W.L.; Sheridan, T.J.; Torrison, L.L.; Zawadzkas, G.A. Sandia National Labs., Albuquerque, NM (USA). 1989. 25p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–5: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013068/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Hermes III is a 22-MV, 730-kA, 40-ns pulsed power accelerator that drives an electron beam diode/converter to generate an intense pulse of bremsstrahlung radiation. In Hermes III, eighty individual 1.1-MV, 220-kA pulses are generated and added in groups of four to develop twenty 1.1-MV, 730-kA pulses which are then fed through inductively isolated cavities and added in series by a magnetically insulated transmission line (MITL). An extension MITL delivers this summed output to the electron beam diode. The construction of Hermes III was completed February 1988 and was followed by an accelerator characterization and performance demonstration phase. Hermes III met all of its performance requirements during this testing period and has gone operational one year ahead of schedule. An overview of the Hermes-III design is presented together with details of the performance obtained for the various subsystems. A discussion of future applications of this technology is also presented. 16 refs., 14 figs., 2 tabs.

32931 (SAND–89-0070C) **Performance of the Hermes-III laser-triggered gas switches.** Denison, G.J.; Alexander, J.A.; Corley, J.P.; Johnson, D.L.; Hodge, K.C.; Manzanares, M.M.; Weber, G.; Hamil, R.A.; Schanwald, L.P.; Ramirez, J.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 19p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-890665–4: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, California, USA, 12-14 Jun 1989). Order Number DE89013071/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper reports the performance of the SF_6 insulated, multistage, laser-triggered gas switch used in the Hermes-III accelerator. In this accelerator, 20 of these switches are used to transfer energy from intermediate energy storage water-dielectric capacitors to the pulse forming lines (PFLs). Approximately 8000 laser-triggered switch shots have been taken with seven prefires. Nearly 70% of these shots have been at nominal operating parameters. The average first-to-last spread in firing times for 20 switches is approximately 8 ns. Removal of systematic differences reduces this spread to ~6 ns. This spread implies a one-sigma jitter for a single switch of <2 ns at 70–75% of self-breakdown voltage. Results show that the jitter does not change significantly over an operating range of 70–90% of self-breakdown. In addition, the jitter is insensitive to the factor of two variation in the laser energy delivered to the various switches by the optical system. A detailed summary on the performance, reliability, and maintenance of the switches and optical system is presented. Initial results of a study to investigate the performance of these switches under varying laser trigger conditions is also presented. 4 refs., 12 figs.

32932 (UCID–21681) **Magnet design technical report—ITER definition phase.** Henning, C. (ed.). Lawrence Livermore National Lab., CA (USA). 28 Apr 1989. 113p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE89012809/JAW. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This report contains papers on the following topics: conceptual design; radiation damage of ITER magnet systems; insulation system of the magnets; critical current density and strain sensitivity; toroidal field coil structural analysis; stress analysis for the ITER central solenoid; and volt-second capabilities and PF magnet configurations.

32933 Numerical study of gyrophase and time-dependent nonadiabatic electron losses in axially symmetric magnetic mirror fields. Wallace, C.B. (BDM Corp., Albuquerque, NM (US)); Prelas, M.A. *Fusion Technology (USA),* 14(2): 284-287 (Sep 1988).

Charged-particle motion in vacuum magnetic fields with 2 degrees of freedom has been investigated by numerically integrating the relativistic Lorentz force equation. The numerical simulation demonstrated that collisionless particle losses due to the nonexistence of a globally conserved quantity other than the energy and canonical angular momentum are gyrophase dependent, thus resulting in the existence of multiple particle confinement times. This is consistent with the cited experimental results and, in addition, demonstrates the indistinct nature of the mirror loss cone for rho/L/ sub M/< 2 x 10/sup -2/.

32934 Design of a large helical system for magnetic fusion experiments. Garabedian, P. R. (Department of Mathematics and Statistics University of Pittsburgh Pittsburg, Pensylvania 15260(US)). *Mathematics of Computation (USA),* 52(186): 539-551 (Apr 1989).

Computer codes are described that solve the partial differntial equations of ideal magnetohydrodynamics describing toroidal equilibrium of a plasma. These numerical methods are applied to find a helical coil winding law for stellarator experiments designed so that the parallel current is relatively low.

32935 Tritium emissions reduction facility. Wieneke, R.E. (Monsanto Research Corp., Mound, Miamisburg, OH (US)); Bowser; Hedley, W.H.; Kissner, T.J.; Lamberger, P.H.; Morgan, F.G.; VanPatten, J.F.; Williams, M.A. *Fusion Technology (USA),* 14(2): 899-903 (Sep 1988).

The Tritium Emissions Reduction Facility (TERF) will be a system for the continuous processing of tritium containing gases collected from various operations at Mound. The basis of the system operation will be the oxidation of elemental hydrogen isotopes and organic molecules at elevated temperatures on precious metal catalyst beds, and the adsorption of the resulting oxide (water) on molecular sieve dryers. The TERF will be expected to handle from 400,000 to 1,000,000 curies of tritium per year in the process gas stream and release no more than 200 curies per year to the atmosphere. Consequently, the TERF will need to convert and capture tritium at low concentrations in gas efficiently and reliability.

32936 The safety record at the tritium systems test assembly. Coffin, D.O. (Los Alamos National Lab., Los Alamos, NM (US)). *Fusion Technology (USA),* 14(2): 893-898 (Sep 1988).

The Tritium Systems Test Assembly (TSTA) has been operating for 4 years with tritium inventories of up to a million Ci and a cumulative (circulated) throughput of over 10 billion Ci to date. During the operational life of the facility 40,000 Ci of HTO waste have been intercepted by the tritium waste treatment system. Stack releases for the 4-year period have totaled < 40 Ci, and exposure to operating personnel has been < 3 mREM/person/yr. This excellent record is due in large part to high priorities placed on tritium-safe design concepts, but real-time computer diagnostics have been equally important in enabling us to anticipate and prevent potential releases of tritium .

32937 Simple, high current LaB_6 cathode. Siegrist, K. (California Institute of Technology, Pasadena, California 91125(US)); Brown, M. R.; Bellan, P. M. *Review of Scientific Instruments (USA),* 60(5): 964-965 (May 1989).

A cathode constructed of a thin, directly heated strip of LaB_6 is described. The cathode is simple to construct, requires modest heating power, has high current emission capability and is quite rugged. Construction details will be given and cathode performance data presented. The cathode has been used in tokamak dc current injection experiments.

32938 A new tritium facility - The Weapons Engineering Tritium Facility at Los Alamos National Laboratory. Nolen, R.L. Jr. (Los Alamos National Lab., Los Alamos, NM (US)); James, B.J.; Hemphill, R.L.; Fuehrer, M.E. *Fusion Technology (USA),* 14(2): 947-952 (Sep 1988).

A new tritium laboratory and process systems have been completed at Los Alamos National Laboratory (LANL). The highly automated Weapons Engineering Tritium Facility (WETF), containing approximately 861 m/sup 2/(8,000 sq ft) of floor space, replaces an aging tritium laboratory. The new facility provides improved protection to personnel involved in tritium handling operations, reduced routine releases of tritium to the atmosphere, and reduced potential for a major tritium release that might result from an accident or a human error.

32939 Estimating the tritiated hydrocarbon decontamination factor by heavy methane. James, B.J. (Los Alamos National Lab., Los Alamos, NM (US)); Nolen, R.L.; Hemphill, R.L.; Fuehrer, M.E. *Fusion Technology (USA),* 14(2): 939-942 (Sep 1988).

As part of the start up of Los Alamos National Laboratory's new tritium-handling facility, the efficiency of a catalytic oxidation tritium decontamination system was investigated using deuterated methane. The tests were performed during the start up of the facility to confirm the operability of the system before introducing tritium and to provide a baseline for comparison. Techniques and instruments normally used for atmospheric tracer experiments using deuterated methane were applied virtually without modification. The sensitivity of this method allowed preliminary checks at the sub-ppm (v/v) level.

32940 Transportation of tritiated waste from fusion facilities. Gruetzmacher, K.M. (Los Alamos National Lab., Los Alamos, NM (US)); Carlson, R.V.; Stencel, J.R.; Sissingh, R.A.P. *Fusion Technology (USA),* 14(2): 966-971 (Sep 1988).

This paper examines methods of handling tritiated waste from a fusion facility. Gaseous effluent from a fusion reactor can currently be transported from a fusion facility in two forms - as a gas or solidified on uranium beds. Tritiated water can be transported if it is solidified by adsorption onto molecular sieve beds or on clay or cement. Solid waste being shipped for disposal can be transported in low specific activity (LSA, less than 0.3 mCi/g [1.1x10/sup 7/Bq/g]), type A (less than or equal to 1000 Ci [3.7x10/sup 13/Bq]) or type B (greater than 1000 Ci [3.7x10/sup 13/Bq]) standard containers. The method chosen for transport depends on the amount and level of activity of the tritiated material and whether or not it will be reprocessed at another facility.

32941 The data collection system for failure/maintenance at the tritium systems test assembly. Casey, M.A. (Los Alamos National Lab., Los Alamos, NM (US)); Gruetzmacher, K.M.; Bartlit, J.R.; Cadwallader, L.C. *Fusion Technology (USA),* 14(2): 962-965 (Sep 1988).

A data collection system for obtaining information which can be used to help determine the reliability and availability of future fusion power plants has been installed at the Los Alamos National Laboratory's Tritium Systems Test Assembly (TSTA). Failure and maintenance data on components of TSTA's tritium systems have been collected since 1984. The focus of the data collection has been TSTA's Tritium Waste Treatment System (TWT), which has maintained high availability since it became operational in 1982. Data collection is still in progress and a total of 291 failure reports are in the data collection system at this time, 47 of which are from the TWT.

32942 A tritium compatible plasma exhaust system for a large tokamak. Rossmassler, R.L. (Princeton Plasma Physics Lab., Princeton, NJ (US)); Lamarche, P.H.; Cherdack, R. *Fusion Technology (USA),* 14(2): 982-987 (Sep 1988).

A tritium compatible system has been designed to handle the exhaust gas produced by neutral beam operations in the Tokamak Fusion Test Reactor (TFTR). The system transfers gas highly concentrated in hydrogen isotopes to intermediate storage and final shipping containers using a combination of dry pumping and gettering. Details are given for functional and design requirements, component characteristics, and estimated system performance. Process flow and equipment arrangements are diagrammed, and various modes of operation are illustrated. The system is designed to provide safe handling of the tritiated exhaust and the rapid tritium turnaround necessary for operation with TFTR's small on-site inventory.

32943 Operating experience and procedures at the tritium systems test assembly. Carlson, R.V. (Los Alamos National Lab., Los Alamos, NM (US)); Binning, K.E.; Cole, S.P.; Jenkins, E.M.; Wilhelm, R.C. *Fusion Technology (USA),* 14(2): 953-957 (Sep 1988).

The Tritium Systems Test Assembly (TSTA), located at the Los Alamos National Laboratory, is a prototype fusion reactor tritium fuel reprocessing system. It was build for the demonstration of tritium handling systems necessary for tritium-burning fusion reactors. Operating procedures are important for the safe and efficient operation of TSTA. TSTA has been operating for four years with tritium in a safe and efficient manner. The inventory of tritium in the process loop is 100 grams and several milestone runs have been completed. This paper describes the methods used to operate TSTA.

32944 Technical aspects of the upgrade and commissioning of the tritium and related systems at TFTR. Cherdack, R.N. (Burns and Roe Co., Princeton Plasma Physics Lab., Princeton, NJ (US)); Sarker, C.R.; Palmer, J.; Tuohy, J.M. *Fusion Technology (USA),* 14(2): 988-994 (Sep 1988).

Systems for delivering tritium to the Tokamak Fusion Test Reactor, and for cleaning the tritiated glovebox and room atmospheres, are being upgraded and commissioned as are the HVAC for the rooms

and areas which will house tritium bearing systems. Major activities on the tritium systems included: alterations to glovebox atmosphere control logic; redesigning of cleanup system skids to allow maintenance and repairs; improvement of process instrumentation and logic, including increased capability for control and monitoring by a distributed control system; addition of a monitored vent system; preparation of operating instructions; and other enhancements. Design of changes to the HVAC are in the conceptual state.

32945 TFTR tritium program. Sissingh, R.A.P. (Princeton Univ., Plasma Physics Lab., Princeton, NJ (US) (CA)); Rossmassler, R.L. *Fusion Technology (USA),* 14(2): 923-928 (Sep 1988).

The Tokamak Fusion Test Reactor (TFTR) at Princeton began operation in December 1982. Since then it has operated successfully with protium and deuterium achieving energy confinement time at peak electron density of 10/sup 19/m/sup -3/s, with ion temperatures of 20 keV. This paper describes the systems and preparations required for D-T operation, i.e. introducing and operating the tokamak with tritium in order to achieve the scientific break even point of Q=1. These systems include the tritium storage and delivery system, the tritium injection systems, the tritium clean-up systems, and the plasma exhaust and collection systems. It is expected that TFTR will have these systems fully operational, with trained personnel.

32946 System design for disposal of tritium at TFTR. Tuohy, J.M. (Burns and Roe Co., Oradell, NJ (US)); Cherdack, R.; Lacy, N.H. *Fusion Technology (USA),* 14(2): 995-999 (Sep 1988).

The Tokamak Fusion Test Reactor (TFTR) has cleanup systems which convert tritium gas to the oxide form and absorb it on molecular sieve beds. These beds are regenerated by transferring their moisture content to disposable sieve beds. Preparing this sieve for disposal can be awkward and hazardous. Monitoring the tritium and moisture content of the disposable sieve is not straightforward. Modifications to the regeneration system at the TFTR are being made to address these concerns and others relating to maintainability.

32947 Tips for the fabrication of temporary tritium experiments. Binning, K.E. (Los Alamos National Lab., Los Alamos, NM (US)); Jenkins, E.M. *Fusion Technology (USA),* 14(2): 958-961 (Sep 1988).

The Tritium System Test Assembly (TSTA) is a facility built for the demonstration of tritium handling systems necessary for tritium-burning fusion reactors. The facility has been in operation handling tritium for four years. The current inventory of tritium is approximately one hundred grams, with DOE approval for a maximum inventory of two hundred grams. Not all experiments performed at TSTA require the operation of the main process loop. During the last four years, many small scale experiments have been performed to test the compatibility and operation of tritium processing components in small self-contained experimental packages. These packages are fabricated inside secondary containment gloveboxes and can be operated for hours or months with little monitoring. Construction of these packages need to be tritium compatible, inexpensive, easy to build, and versatile. This paper discusses some of the problems and remedies encountered during the building of temporary experiments.

32948 Tritium proof-of-principle injector experiment. Fisher, P.W. (Oak Ridge National Lab., Oak Ridge, TN (US)); Milora, S.L.; Combs, S.K.; Carlson, R.V.; Coffin, D.O. *Fusion Technology (USA),* 14(2): 977-981 (Sep 1988).

The Tritium Proof-of-Principle (TPOP) pellet injector was designed and built by Oak Ridge National Laboratory (ORNL) to evaluate the production and acceleration of tritium pellets for fueling future fusion reactors. The injector uses the pipe-gun concept to form pellets directly in a short liquid-helium-cooled section of the barrel. Pellets are accelerated by using high-pressure hydrogen supplied from a fast solenoid valve. A versatile, tritium-compatible gas-handling system provides all of the functions needed to operate the gun, including feed gas pressure control and flow control, plus helium separation and preparation of mixtures. These systems are contained in a glovebox for secondary containment of tritium. Tritium experiments will be carried out at the Tritium Systems Test Assembly (TSTA) at Los Alamos National Laboratory (LANL).

32949 A tritium-compatible piezoelectric valve for the Tokamak Fusion Test Reactor. Coffin, D.O. (Los Alamos National Lab., Los Alamos, NM (US)); Cole, S.P.; Wilhelm, R.C. *Fusion Technology (USA),* 14(2): 972-976 (Sep 1988).

A commercial piezoelectric valve has been modified to enhance its tritium compatibility, enabling it to provide about 125 tritium gas injections planned for Princeton's Tokamak Fusion Test Reactor (TFTR). The valve was modified at Los Alamos National Laboratory (LANL), exposed to progressively higher concentrations to tritium gas, and repeatedly tested for performance with tritium. The modified valve meets the basic TFTR flow requirements (50 torr L/s), and it survived 3400 torr hr exposure to tritium with neither decrease in performance nor significant leakage across the closed valve. A totally tritium-compatible piezo valve, containing no organic materials, is also proposed and described.

32950 Tritium detectors employed at the Tokamak Fusion Test Reactor. Gentile, C.A. Jr. (Princeton Univ., Plasma Physics Lab., Princeton, NJ (US)). *Fusion Technology (USA),* 14(2): 1058-1060 (Sep 1988).

In preparation for deuterium-tritium operations at the Tokamak Fusion Test Reactor (TFTR) in 1991, Princeton University, Plasma Physics Laboratory has developed a real-time tritium monitoring system. The system employs a variety of different monitors, the purpose of which is to provide tritium concentration levels for personnel protection, process streams, and stack effluent monitoring.

32951 Improvements in efficiency, capacity, and reliability of Mound's effluent removal system. Hedley, W.H. (Monsanto Research Corp., Mound, Miamisburg, OH (US)); Lamberger, P.H.; Gibbs, G.E.; Colvin, C.M. *Fusion Technology (USA),* 14(2): 1010-1013 (Sep 1988).

Measurements at Mound have shown that the tritium capture system removes all but 500 curies per year of the 500,000 to 1,000,000 curies per year of tritium fed to it. Analyses of the gases emitted from the system show that over 95 percent of the escaping tritium has been in the form of organic tritium compounds. A new, more efficient reactor now oxidizes over 99 percent of the 5000 curies per year of organic tritium compounds fed to it (as compared to 90 percent by the existing reactors). The capacity and reliability of the system have also been improved by installing a new, larger, variable-speed compressor.

32952 Physical inventory by use of modeling for the tritium aqueous waste recovery system. Sienkiewicz, C.J. (Monsanto Research Corp., Mound, Miamisburg, OH (US)); Lentz, J.E.; Wiggins, D.V. *Fusion Technology (USA),* 14(2): 1096-1101 (Sep 1988).

Physical inventory requirements for the Tritium Aqueous Waste Recovery System (TAWRS) present constraints that required unique solutions. Available analytical techniques for which sound measurement control practices existed could not be readily adapted to the system without significant modifications and expense. A mathematical model was developed that accurately estimates total system inventory, given a few key measurements. Tritium concentrations in two streams, the tritiated feed stream to the process and the tritiated hydrogen stream generated by the electrolysis cells, provides the key values to the model. The model relates the tritium concentration throughout the system to the tritium concentration in these two streams. Testing of the system using low-level tritiated feed water was conducted to characterize tritium distribution in the system and to relate key values to total inventory.

32953 TFTR health physics tritium measurements following D-D operations. Stencil, J.R. (Princeton Plasma Physics Lab., Princeton, NJ (US)); Gilbert, J.D.; Griesbach, O.A.; Greco, J.M. *Fusion Technology (USA),* 14(2): 1047-1053 (Sep 1988).

Measurements within the Tokamak Fusion Test Reactor (TFTR) vacuum vessel atmosphere in 1985 indicated low levels of tritium oxide (HTO). From January to July 1987 approximately 3 x 10/sup 18/D-D fusion neutrons were produced in TFTR operations. These reactions would be expected to produce a triton for each reaction or 5.4 GBq (145 milliCuries) of tritium. An HTO measurement made of the vessel on 7/10/87, five days after the last pulsing of the machine, but before the machine was let up to air, indicated and HTO level of 1 MBq m/sup -3/(28 μCi m/sup -3/) or approximately six times the DOE concentration guide value of 185 kBq m/sup -3/(5

μCi m/sup -3/). The ICRP 30 Derived Air Concentration (DAC) limit of 800 kBq m/sup -3/(22 μCi m/sup -3/) will become the limit when Draft DOE Order 5480.11 is implemented. A venting program for the vessel was set up with the objective of limiting the internal dose equivalent to personnel working inside the vacuum vessel. An HTO/HT measurement indicated a 57:1 ratio.

32954 Time-of-flight mass spectrometer for investigating hydrogen isotope interactions. Gill, J.T. (Monsanto Research Corp. - Mound, Miamisburg, OH (US)); Watkins, D.B.; Rigano, J.N.; Clift, W.A.; Watkins, R.A.; Burwinkle, A.L.; Schultz, J.A.; Anderson, L.R.; Schmidt, H.K. *Fusion Technology (USA),* 14(2): 1026-1035 (Sep 1988).

Time-of-flight Secondary Ion Mass Spectrometry/Direct Recoil (TOF SIMS/DR) techniques and apparatus are described which hold substantial promise for further understanding the behavior of hydrogen isotopes at surfaces. The analytical apparatus is interfaced to a tritium-compatible exposure cell within a glovebox by means of a vacuum load-lock. Apparatus consists of a pulse Li/sup +/beam for H/D/T ratios (DR), a DC or pulsed Cs/sup +/beam for sputtering or TOF/SIMS (for enhancement of negative ion yields), and a dual channel 10 MHz time-digitizing histogrammer for fast data rates. Prototype apparatus has already proved useful in understanding the rates at which hydrogen isotopes may be exchanged from material surfaces upon exposure to water vapor. An extremely fast and a second much slower process characterize the exchange at Si and stainless steel oxyhydroxide surface films. The fast process is limited by the rate at which water molecules strike the top monolayer of the surface. H/D exchange tunneling appears to be involved. The slow process appears to be the bulk diffusion-limited exchange rate within the oxyhydroxide film. Diffusion constants have been derived.

32955 Measurement and prediction of tritium holdup. Ellefson, R.E. (Monsanto Research Corp., Miamisburg, OH (US)); Lindsay, C.N.; Johns, E.E. *Fusion Technology (USA),* 14(2): 1036-1040 (Sep 1988).

Total inventory of tritium requires quantitation of the residual tritium that remains in the process after a normal measurement of bulk gas inventory by PVT/Gas Analysis methods. Two process elements known to exhibit this holdup are uranium getter pumps (U-beds) and molecular sieve traps. Methods for measurement of holdup on these process elements are presented based on isotopic dilution (H or D). For the U-bed, a qualified method for prediction of holdup is presented based on the flow rate as a function of time for the evolved gas. The method is noninvasive, uses data from the normal inventory bakeoff and allows a shortened bakeoff period for inventory measurement.

32956 Solid-state nuclear detectors for monitoring low levels of tritium. McCann, W.J. (Radiation Monitoring Devices, Inc., Watertown, MA (US)); Entine, G.; Farrell, R.F.; Clapp, A.; Squillante, M.R. *Fusion Technology (USA),* 14(2): 1041-1046 (Sep 1988).

Low noise silicon avalanche photodiodes (APDs) with ultra thin surface dead layers have been developed for detecting tritium beta particles. Unlike the present windowless proportional counters and liquid scintillation techniques this alternative requires no liquid or flowing gases and has the reliability and compactness of solid-state detector technology. The authors have carried out detector research to study and optimize the physical and electrical properties of APDs for nuclear spectroscopy. A particular emphasis has been placed on reducing the noise and surface dead layer of large area avalanche photodiodes (1 cm diameter) in order to maximize the quantum efficiency for detecting low energy betas, as well as to investigate the effects of changing temperature, bias, and leakage current on avalanche gain, signal-to-noise and tritium detection quantum efficiency.

32957 Dispersion of HT and HTO following an unplanned release of tritium to the atmosphere. Kurzeja, R.J. (E.I. du Pont de Nemours and Co., Savannah River Lab., Aiken, SC (US)); Murphy, C.E. Jr.; Taylor, R.W. *Fusion Technology (USA),* 14(2): 1111-1114 (Sep 1988).

An unplanned release of 168,000 Ci of elemental tritium (HT) and 4700 Ci of tritium oxide (HTO) occurred on July 31, 1987 from the Savannah River Plant. The oxide fraction in the exhaust tract was determined to be 2.7%. The air concentrations of HT and HTO were also measured at 43 downwind locations. The oxide fraction varied between 2 and 3% at the plant boundary (12 miles downwind) and between 0.3% and 84% at greater downwind distances (15 to 40 miles). The increased variability of the oxide fraction with downwind distance is attributed to exchange of oxide with surface vegetation and to turbulent transfer between the surface and the boundary layer. These results are relevant to a recent study of HT oxidation based on downwind changes in the HT/HTO ratio.

32958 Preliminary risks associated with postulated tritium release from production reactor operation. O'Kula, K.R. (Science Applications International Corp., Savannah River Lab., Aiken, SC (US)); Horton, W.H. *Fusion Technology (USA),* 14(2): 1130-1135 (Sep 1988).

The Probabilistic Risk Assessment (PRA) of Savannah River Plant (SRP) reactor operation is evaluating the offsite risk due to tritium releases during postulated full or partial loss of heavy water moderator accidents. Preliminary determination of the frequency of average partial moderator loss (including incidents with leaks as small as 0.5 kg) yields an estimate of ~1 per reactor-year. The full moderator loss frequency is conservatively chosen as 5x10/sup -3/ per reactor-year. Conditional consequences, determined with a version of the MACCS code modified to handle tritium, are found to be insignificant. The 95th percentile individual cancer risk is 2x10/sup -6/per reactor-year within 16 km of the release point. The full moderator loss accident contributes about 80% of the evaluated risks.

32959 A model for global cycling of tritium. Killough, G.G. (Hendecagon Corp., Oak Ridge, TN (US)); Kocher, D.C. *Fusion Technology (USA),* 14(2): 1115-1120 (Sep 1988).

Dynamic compartment models are widely used to describe global cycling of radionuclides for purposes of dose estimation. In this paper the authors present a new global tritium model that reproduces environmental time-series data on concentrations in precipitation, ocean surface waters, and surface fresh waters in the northern hemisphere, concentrations of atmospheric tritium in the southern hemisphere, and the latitude dependence of tritium in both hemispheres. Names TRICYCLE (for TRItium CYCLE) the model is based on the global hydrologic cycle and includes hemispheric stratospheric compartments, disaggregation of the troposphere and ocean surface waters into eight latitude zones, consideration of the different concentrations of atmospheric tritium over land and over the ocean, and a diffusive model for transport in the ocean. TRICYCLE reproduces the environmental data if it is assumed that about 50% of the tritium from atmospheric weapons testing was injected directly into the northern stratosphere as HTO. The model's latitudinal disaggregation permits taking into account the distribution of population. For a uniformly distributed release of HTO into the worldwide troposphere, TRICYCLE predicts a collective dose commitment to the world population that exceeds the NCRP model's corresponding prediction by a factor of three.

32960 U.S. team measurements during the June 1987 experimental HT release at the Chalk River Nuclear Laboratories, Ontario, Canada. Jalbert, R.A. (Los Alamos National Lab., Los Alamos, NM (US)); Murphy, C.E. *Fusion Technology (USA),* 14(2): 1182-1186 (Sep 1988).

In June 1987, an experiment was performed at the Chalk River Nuclear Laboratories in Ontario, Canada, to study the oxidation of HT in the environment. The experiment involved a 30-minute release of 3.54 TBq (95.7 Ci) of HT to the atmosphere at an elevation of one meter. The HTO/HT ratios were shown to slowly increase downwind (~ 4 x 10/sup -5/at 50 meters to almost 10/sup -3/at 400 meters) as conversion of HT takes place. For several days after the release, HTO concentrations in the atmosphere remained elevated. Freeze-dried water from vegetation samples was found to be very low in HTO immediately after the release suggesting a very low direct uptake of HTO in air by vegetation. The free-HTO concentration in vegetation increased during the first day, peaking during the second day (about 1.5 - 3.0 x 10/sup 4/Bq/L at 50 meters from the source) and decreasing by the end of the second day. The organically bound tritium continued to accumulate during the period following exposure (about 400 Bq/kg dry weight at 50 meters after two days).

32961 Operational experience with the DATS sampler during the Canadian tritium modeling experiment. Griesbach, O.A. (Princeton Plasma Physics Lab., Princeton, NJ (US)); Stencel, J.R. *Fusion Technology (USA)*, 14(2): 1199-1202 (Sep 1988).

An international tritium model validation experiment was held at Chalk River, Canada, during June 1987. The Princeton Plasma Physics Laboratory (PPPL) Differential Atmospheric Tritium Sampler (DATS) was one of the many types of tritium samplers used for this experiment. Besides the modeling data that were produced from this experiment, the authors learned how well our tritium samplers performed when a known tritium quantity was released. The DATS were set up at 50, 100, 200, and 400 meters downwind from the release point. Data were collected during the release period and for the next 24 hours. While the units worked very well in the field, valued operational experience was gained in the recovery of the tritium from the silica gel. Because of delays in the analysis of the collected samples, it became difficult to recover the HTO fraction quantitatively. Indications are that molecular sieves are more suitable for samples which are not going to be processed immediately. This paper reports on the field set up, the measurement results, and operational experience.

32962 Comments on the gas-phase initial rate of tritiated water formation. Failor, R.A. (Lawrence Livermore National Lab., Livermore, CA (US)); Souers, P.C.; Prussin, S.G. *Fusion Technology (USA)*, 14(2): 1136-1140 (Sep 1988).

A critical evaluation was made of the experimental data regarding the rate of tritiated water formation. The evaluation tested the validity of the rate expression. The experimental data does not appear to support the use of this rate expression for predicting tritiated water formation rates over wide ranges of initial tritium concentrations and large spans of reaction times. Modeling results are discussed which indicate the complexity of the tritiated water formation mechanism. The simplicity can not express the effects of the mechanistic complexity on the rate.

32963 Operation of the TSTA isotope separation system with 100 gram tritium. Sherman, R.H. (Los Alamos National Lab., Los Alamos, NM (JP)); Bartlit, J.R.; Gruetzmacher, K.M.; Yoshida, H.; Yamanishi, T.; Naito, T.; Hirata, S.; Naruse, Y. *Fusion Technology (USA)*, 14(2): 1273-1276 (Sep 1988).

In March of 1988 full operation of the 4-column isotope separation system (ISS) was realized in runs that approximated the design load of tritium. Previous operations had been fraught with operating difficulties principally due to external systems. This report will examine the recent highly successful 6-day period of operation. During this time the system was cooled from room temperature, loaded with hydrogen isotopes including 109 grams of tritium, integrated with the transfer pumping, impurity injection, and impurity removal systems, as well as the remote computer control system. At the end of the operation 12 grams of tritium having a measured purity of 99.987% (remainder deuterium) were offloaded from the system. Observed profiles in the columns in general agree with computer models. A Height Equivalent to a Theoretical Plate (HETP) of 5.0 cm is confirmed.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 31575

32964 (INIS-mf–11426) **BARC annual report 1987.** Bhabha Atomic Research Centre, Bombay (India). Nov 1988. 120p. Order Number DE89614750/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The report summarises the Research and Development (R and D) activities of the Bhabha Atomic Research Centre, Bombay, during 1987. These R and D activities are described in the chapters entitled: Physical Sciences, Chemical S ciences, Materials and Materials Sciences, Radioisotopes, Reactors, Fuel Cycle, Radiological Safety and Protection, Electronics and Instrumentation, Engineering Services, and Life Sciences. Activities in the fields of remote handling and robotics, technology transfer, and auxiliary activities like technical information, human resources and development etc. are dealt in the chapter entitled General. At the end of each chapter, a list of publications by the scientists in the corresp onding subject field is given. Some of the major highlights of the work during 1987 are: (1) DHRUVA reactor became fully operational at its rated capacity making neutrons available for isotope production and studies in neutron scattering and condensed matter, (2) R and D activities were extended to study h igh temperature superconductivity in both fundamental and applied aspects and (3) a laboratory for production of /sup 32/P-biomolecules was set up at the Centre for Cellular and Molecular Biology at Hyderabad. (M.G.B.).

9901 Management

Refer also to citation(s) 30899

32965 (CONF-890657–2) **Systems approach to project management.** Medley, L.G. Sr. Oak Ridge National Lab., TN (USA). Feb 1989. 22p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 33. annual meeting of the American Association of Cost Engineers; San Diego, California, USA; 25-28 Jun 1989. Order Number DE89008741/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In 1979, UCC-ND Engineering management decided to study the overall engineering process in light of new methodologies and management techniques to determine how it could be improved and made more uniform. The system had evolved piecemeal over a period of 36 years. A prime objective was to provide a common framework for understanding the project management process. Systems methodology was chosen as the means for analyzing and integrating a wide variety of activities required for successful project management. This application is very effective and resulted in the creation of a model that serves as the desired framework for understanding project management. Other benefits include improvements to the Engineering Procedures Manual, additional reference material, and enhanced use of a variety of management tools. 3 tabs.

32966 (CONF-8906113–1) **The dynamic duo: New technology and willing staff.** Norton, N.P. Oak Ridge National Lab., TN (USA). 1989. 6p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From DOE technical information meeting: INFOTECH; Oak Ridge, Tennessee, USA; 6-7 Jun 1989. Order Number DE89012345/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The intrinsic interrelatedness of information staff and new technology are explored. While technology is an essential in maximizing staff resources, staff attitude and expertise are also essential to the successful implementation of new technology. Suggestions are offered for achieving staff understanding and acceptance of new technology.

32967 (DOE/MA–0372) **Annual procurement and financial report, FY 1988.** USDOE Assistant Secretary for Management and Administration, Washington, DC (USA). Procurement and Assistance Management. Apr 1989. 32p. Sponsored by DOE Management & Administration. Order Number DE89012564/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The procurement and financial assistance activity of the Department of Energy (DOE) is unique in the Federal Government. DOE is generally not a consumer of the technology it develops, nor does it procure production quantities of hardware for its own use. DOE is involved in basic and applied research in a wide range of technology areas including the following: nuclear energy, nuclear waste management, fossil energy, conservation, renewable energy, and nuclear weapons development. The DOE procurement activities also support national security in the production and testing of nuclear weapons and the management of the Strategic Petroleum Reserve and the Naval Petroleum and Oil Shale Reserves. With the exception of the national security activities and departmental administration. DOE spends its procurement dollars more as a catalyst for technology development than for acquiring goods and services for Federal use. DOE enters into contractual arrangements with large and small firms involved in the technology areas for which it is responsible. In addition, DOE is involved in contractual and financial assistance activities with educational institutions, nonprofit organizations, and State and local governments. DOE offers substantial opportunities for small and small disadvantaged business enterprises, both as DOE prime contractors and as subcontractors to the

management and operating contractors. As one of the agencies designated by the Small Business Innovation Development Act of 1982, a portion of DOE's research and development budget is set aside each year for research awards to small businesses.

32968 (EGG-M–89013) **Applying understanding of individual behavior and team dynamics within the value engineering process.** Parker, G.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1989. 6p. Sponsored by DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-890691–2: Society of American Value Engineers international conference, Indianapolis, Indiana, USA, 12-14 Jun 1989). Order Number DE89011126/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes several new value engineering (VE) process techniques and the individual behavior and team dynamics related to them. 3 refs., 3 figs.

32969 (INIS-BR–1474) **National Energy Balance - 1982.** Anon. Ministerio das Minas e Energia, Brasilia, DF (Brazil). 1982. 114p. (In Portuguese). Order Number DE89617502/JAW. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The National Energy Balance - 1982 presents information in level of economic sectors, as well as separation between primary and secondary energy sources, as well as its energy fluxes. (E.G.).

32970 (INIS-GB–187) **Corporate plan 1989.** Science and Engineering Research Council, Swindon (UK). Dec 1988. 54p. Order Number DE89617503/JAW. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The paper presents the United Kingdom Science and Engineering Research Council's second Corporate Plan 1989. The Corporate Plan comprises statements of the current objectives of the Astronomy and Planetary Science Board, the Engineering Board, the Nuclear Physics Board, the Atmospheric Sciences and Computing Centre, along with a discussion of the mechanisms for their attainment. The Annex contains a description of some scientific highlights between 1985-1989, as well as a review of progress between 1984-5 to 1987-8. (U.K.).

32971 (INIS-mf–11441) **Program of research 1988-89.** Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia). Aug 1988. 37p. Order Number DE89617504/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

From 1 July 1988, the research activities of ANSTO have reorganised into five programs: advanced materials; applications of nuclear physics; environmental science; applications of radioisotopes and radiation; biomedicine and health. This structure not only groups the main research activities but also identifies the underpinning of ANSTO's commercial activities. This document describes the projects to be undertaken in the 1988-89 financial year. Each project in a particular program area is defined in terms of background, objective, recent work and achievements, work planned, resources and the project manager is identified. Research is also undertaken in areas of the operational activities of the organisation and these also are detailed.

32972 (NAC–87-10) **Neutron beam facility at NAC.** Cornell, J.C. Council for Scientific and Industrial Research, Pretoria (South Africa). National Accelerator Centre. 1987. 17p. Available from the CSIR, National Accelerator Centre, P.O. Box 72, Faure, South Africa.

A proposal for an experiment to measure neutron-proton radiative capture at NAC prompted the NAC to construct a facility for producing a collimated beam of (nearly) mono-energetic neutrons for experiments. The neutron beam thus produced will initially be used to measure the angular distribution of photons from the H(n,γ)D reaction, between 20 and 200 MeV. Deuterons from the n-p capture in a liquid scintillator will be detected in coincidence with the capture gamma rays. The differential cross sections derived from the experiment will be compared with thoeretical predictions. Polarized neutrons, produced at a non-zero angle to the incident beam direction may later be used to measure the analysing power in n-p radiative capture.

32973 (UCRL–100655) **Learning the value of VE.** Sperling, R.B. Lawrence Livermore National Lab., CA (USA). 3 Mar 1989. 7p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890691–1: Society of American Value Engineers international conference, Indianapolis, Indiana, USA, 12-14 Jun 1989). Order Number DE89008121/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Describing lessons learned from Value Engineers (VE) studies at a government-funded research laboratory reveals how project managers were encouraged to use VE and how their projects benefited from the VE savings. The five major lessons were: An officer of "free" VE is a low-risk incentive to encourage the use of VE; More costs savings can be identified by VE studies than cost reviews or design reviews; Large projects can benefit from repeat VE studies; VE teams can identify surprising savings when allowed to challenge all design criteria; VE programs can be costs effective even though return on investment may vary among projects. 6 tabs.

9902 Mathematics and Computers

Refer also to citation(s) 30294, 30336, 30747, 30748, 30790, 30791, 30794, 30838, 30860, 30861, 30862, 30876, 30877, 30900, 30920, 30921, 30970, 30990, 31035, 31038, 31159, 31161, 31188, 31215, 31216, 31233, 31235, 31246, 31273, 31335, 31337, 31342, 31465, 31594, 31595, 31608, 31618, 31619, 31620, 31621, 31634, 31636, 31654, 31703, 31721, 31737, 31767, 31804, 31808, 31820, 31875, 31891, 31894, 31900, 31907, 31941, 31942, 32185, 32430, 32529, 32530, 32531, 32681, 32754, 32907, 32936, 32952, 32963, 33024, 33029, 33030

32974 (AD-A–204126/7/XAB) **QLISP for parallel processors. Final report, 15 July 1986-31 July 1988.** McCarthy, J. Stanford Univ., CA (USA). Dept. of Computer Science. Jan 1989. 4p. Available from NTIS, PC A02/MF A01.

The goal of the QLISP project at Stanford is to gain experience with the shared-memory, queue-based approach to parallel Lisp, by implementing the QLISP language on an actual multiprocessor, and by developing a symbolic algebra system as a testbed application. The experiments performed on the simulator included: 1. Algorithms for sorting and basic data-structure manipulation for polynomials. 2. Partitioning and scheduling methods for parallel programming. 3. Parallelizing the production rule system OPS5.

32975 (AD-A–204164/8/XAB) **Comparison of several iterative techniques in the solution of symmetric banded equations on a two-pipe Cyber 205. Technical report, 1 October 1987-30 September 1988.** Scandrett, C. Naval Postgraduate School, Monterey, CA (USA). Nov 1988. 33p. (NPS–53-89-006). Available from NTIS, PC A03/MF A01.

The effectiveness of several iterative techniques for solving matrix equations resulting from finite-difference approximations to self-adjoint parabolic and elliptic partial differential equations is reviewed. The techniques include Stone's Strongly Implicit Procedure (SIP) and several conjugate gradient algorithms with varying preconditioners. The comparison is made on a vector machine (two-pipe Cyber 205) where vectorization of the code is done primarily by the vector machine compiler available. It is found that of the methods studied, POLCG (Polynominal Preconditioned Conjugate Gradient Method) and MICCG (Modified Incomplete Cholesky Conjugate Gradient Method) appear to require the least amount of central processing time. An advantage of MICCG and POLCG is that it is less sensitive to increasing matrix size. Its disadvantages are that it requires an iteration parameter, has a greater set-up time, and needs more storage than POLCG.

32976 (AD-A–204258/8/XAB) **Architectural considerations, software support, and compiler issues in multi-computer implementation. Final report, 5 September 1985-31 October 1988.** Agrawal, D.P.; Mauney, J. North Carolina State Univ., Raleigh, NC (USA). 28 Dec 1988. 7p. Available from NTIS, PC A02/MF A01.

The authors studied the problem of efficient execution of programs on parallel computers – and on the B-HIVE architecture in particular — and the software support required, concentrating on programming language implementation. In a loosely-coupled multiprocessing environment, in which processors communicate over a generalized hypercube or similar network, the cost of sharing data among processes is quite high. Techniques of minimizing the total

communication cost in parallel programs were studied. The authors also looked into ways of introducing parallelism in combinatorial problems and observed the impact of randomization on the system speedup. Besides the speedup, the network connectivity and data distribution in parallel and distributed systems play a very important role in determining the system performance. Reliability of such systems under different environments was computed. In addition, the design of topologies with limited connections, which could be appropriate for both LAN and MAN applications was studied.

32977 (AD-A–204463/4/XAB) **Beta operation: a parallel primitive. Doctoral thesis.** Cohn, E.R. Stanford Univ., CA (USA). Dept. of Computer Science. Nov 1988. 70p. (STAN-CS–88-1231). Available from NTIS, PC A04/MF A01.

The ever-decreasing cost of computer processors has created a great interest in multiprocessor computers. However, along with the increased power that this parallelism brings, comes increased complexity in programming. One approach to lessening this complexity is to provide the programmer with general-purpose parallel primitives that shield him from the structure of the underlying machine. There are two contending goals that must be satisfied when designing primitives. On one hand we would like to make the primitives as general and abstract as possible. The more general a primitive is, the more easily it can be used as a building block for creating complex algorithmic constructs. On the other hand, we want to avoid making the primitive so general that it becomes inefficient. In The Connection Machine, Hillis suggests the beta operation as a parallel primitives for his hypercube-based machine. The author examines the beta operation, demonstrates its efficiency, generalize it in several directions, and shows its suitability for general use.

32978 (AD-A–204577/1/XAB) **Parallel QR factorization algorithm using local pivoting.** Bischof, C.H. Cornell Univ., Ithaca, NY (USA). Mathematical Sciences Inst. Nov 1988. 10p. Available from NTIS, PC A02/MF A01.

Pub. in IEEE, 400-407(Nov 1988).

This reprint presents a new parallel version of the Householder algorithm with column pivoting for computing the QR factorization of a matrix. In contrast to the standard algorithm, a local pivoting scheme is used that allows for efficient implementation of the algorithm on a parallel machine, in particular one with a distributed architecture. An inexpensive but reliable incremental condition estimator is used to control the selection of pivot columns by obtaining cheap estimates for the smallest singular value of the currently created upper triangular matrix R. Numerical experiments show that the local pivoting strategy behaves about as well as the traditional global pivoting strategy. They also show the advantages of incorporating the controlled pivoting strategy into the traditional QR algorithm to guard against the known pathological cases.

32979 (AD-A–204609/2/XAB) **Using control states for parallelism extraction. Final report, 1 March 1987-30 June 1988.** Gannon, J. Maryland Univ., College Park, MD (USA). Dept. of Computer Science. 23 Aug 1988. 6p. Available from NTIS, PC A02/MF A01.

Pub. in Proceedings of International Conference on Parallel Processing, Vol. 2, 135-139(1988).

Existing work on parallelism extraction usually occupies one of two categories: DO-loop methods that use the loop index value space for analysis, and stream methods that examine data-flow graphs. The authors method combines some of the advantages of the loop and stream approaches through a generalization of the DO loop index variable called a controlled-state concept. With control states, the can deal with loops and with loop bodies containing if's. He describes the controlled state concept and how it can used to extract parallelism.

32980 (AD-A–204611/8/XAB) **Supercomputers for solving PDE problems. Final report, 1 October 1985-31 March 1988.** Hwang, K. Rancho Los Amigos Medical Center, Downey, CA (USA). 1 Nov 1988. 2p. Available from NTIS, PC A02/MF A01.

Researchers investigated several supercomputer architectures in the context of assessing their performance in solving PDE problems. Main results are: assessed various classes of paralled and vector supercomputers and parallel software issues toward solving PDE problems; developed a multipipeline networking technique for compound vector processing; developed an orthogonal multiprocessor for large-grain scientific computations; improved parallel efficiency of a domain decomposition method, the DD algorithm.

32981 (ANL/TM–466) **ANL site response for the DOE FY1991 information technology resources long-range plan.** Boxberger, L.M.; Caruthers, C.M. (ed.). Argonne National Lab., IL (USA). Mar 1989. 193p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE89012245/JAW. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

As one of a continuing series, this Site Response is an update and extension of the Laboratory's previous submissions. The response contains both narrative and tabular material. It covers an eight-year period consisting of the base year (FY1988), the current year (FY1989), the budget year (FY1990), the plan year (FY1991), and the out years (FY1992–FY1995). This Site Response was compiled by Argonne National Laboratory's Computing and Telecommunications Division, which has the responsibility to provide leadership in optimizing computing and information services and disseminating computer-related technologies throughout the Laboratory. the Site Response consists of four parts. Part 1: "Site Overview" describes the ANL Mission, overall organization structure, the strategic approach toward meeting information technology resource needs, the planning process, major issues, and points of contact. Part 2A: "Information Systems Plans for DOE Contractors" defines the current and planned automated information systems associated with the management of ANL, the stewardship of its resources, and the provision of day-to-day general operations and services. (Part 2B: "Information Systems Plans for DOE Organizations" and Part 2C: "FMS Plans for DOE Organizations" do not apply to Argonne National Laboratory.) Part 3: "Computing Resources Plan" defines the requirements, resources, acquisitions, and budget for computing at ANL for FY1988 through FY1995. Part 4: "Telecommunications Plan" documents the existing and planned telecommunications resources required at ANL from FY 1988 through FY 1995. 46 figs., 26 tabs.

32982 (CEA-CONF–9694) **Neutron and gamma transport in air by TRIPOLI-2 time dependent energy deposition and electron current calculation.** Vergnaud, T.; Nimal, J.C.; Ulpat, J.P.; Faucheux, G. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. 1988. 6p. (CONF-880906–: 7. international conference on radiation shielding, Bournemouth, UK, 12-16 Sep 1988). Order Number DE89760576/JAW. Available from NTIS (US Sales Only), PC A02/MF A01.

The electromagnetic field due to an air explosion is here studied: neutron and the gamma-rays, generated by neutronic reactions, deposit energy which ionizes atmosphere; recoil electrons are also created by gamma collisions. This data set allows to solve the Maxwell equations which manage the electromagnetic field. The TRIPOLI-2 code studies the coupled neutron-gamma transport in 3D- geometries by the Monte Carlo method. The code has been modified to calculate the photon energy deposited in matter and the recoil electron current created by Compton effect. The method is tested wiht a simple case; then neutron and gamma transport is studied in air kerma, deposited photon energy, electron current are calculated as functions of space and time and the contributions of the different neutronic reactions are separately evaluated. The calculations presented here are only part of studies about this subject. Developments will relate three dimensional calculations and the existence of several materials (ground, various air densities).

32983 (CONF-890657–1) **ORMONTE: A PC code for cost/risk analysis.** Williams, K. A. Oak Ridge National Lab., TN (USA). 1989. 21p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OR21400. From 33. annual meeting of the American Association of Cost Engineers; San Diego, California, USA; 25-28 Jun 1989. Order Number DE89005129/JAW. Available from NTIS, PC A03/MF A01 - OSTI.

Discussed in this paper are the rationale for considering uncertainty in cost modeling, the unique features of ORMONTE, the mathematical principles behind the Monte Carlo method used in ORMONTE, the description of an example economic model developed to illustrate the use of ORMONTE, a concise description of the ORMONTE driver code itself, a sample uncertainty analysis for

the economic cost model driven by ORMONTE, a description of how probabilistic information from ORMONTE can be used to evaluate the risk associated with a deterministic estimate, descriptions of some real world applications of ORMONTE to energy-related projects under development by the US Department of Energy, and the computing requirements for ORMONTE. 18 refs., 9 figs., 1 tab.

32984 (CONF-890662–1) **Source-level transformations for multiple specialization of horn clauses.** Winsborough, W. Argonne National Lab., IL (USA). 1989. 19p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From 6. international logic programming conference; Lisbon, Portugal; 19-23 Jun 1989. Order Number DE89005804/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We present a general purpose source-level transformation for logic programs. The transformed program is an annotated and expanded version of the original program. Qualitatively distinct calls on each predicate in the original program (e.g., calls with distinct modes) are rewritten as calls on distinct new variants of the predicate. In the transformed program each new predicate is activated more uniformly, permitting more advantage to be achieved by existing optimization techniques, such as occur-check reduction, automatic parallelization, and optimizations based on mode declarations. When existing optimization techniques are applied to the transformed program, the net effect on the original program is to create several specializations of each predicate, each for a distinct class of use, with no overhead required at run time to select the appropriate specialization for each invocation of a call in the program. Our transformation is based on an abstract interpretation of logic programs that computes, for each program predicate, separate descriptions of several different activations that could occur during execution. Using our transformation, specialized implementations of the predicate can be created and called for each computed predicate-activation description. The collection of activation descriptions given by the abstract interpretation obeys a useful reachability-closure property that allows our transformation to select at compile time a suitable specialized version of the predicate for every call in the transformed program text. Because our transformation technique is based on an abstract interpretation that is parameterized by an application-determined abstract domain, the technique can be applied in virtually any flow analysis of logic programs. 24 refs., 4 figs.

32985 (CONF-890693–2) **A theoretical investigation of a parallel genetic algorithm.** Pettey, C.C.; Leuze, M.R. Oak Ridge National Lab., TN (USA). 1989. 12p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From 3. international conference on genetic algorithms; Washington, D.C., USA; 4-7 Jun 1989. Order Number DE89012508/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In the past few years the limitations of uniprocessor computing systems and the increasing availability of multiprocessors have led to investigations of parallel genetic algorithms. One algorithm in particular, called PGA, consists of a set of communicating sequential genetic algorithms. This paper includes an investigation of the theoretical allocation of trials to schemata by PGA's in general and by a particular PGA (which performs communication in a uniformly random manner) along with an experimental validation of an assumption made in the theoretical investigation. 17 refs., 4 figs.

32986 (CONF-8904210–1) **Attaching IBM-compatible 3380 disks to Cray X-MP.** Engert, D.E.; Midlock, J.L. Argonne National Lab., IL (USA). 1989. 8p. Sponsored by DOE Energy Research. DOE Contract W-31109-ENG-38. From Cray user's group conference; Los Angeles, California, USA; 24-28 Apr 1989. Order Number DE89012383/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A method of attaching IBM-compatible 3380 disks directly to a Cray X-MP via the XIOP with a BMC is described. The IBM 3380 disks appear to the UNICOS operating system as DD-29 disks with UNICOS file systems. IBM 3380 disks provide cheap, reliable large capacity disk storage. Combined with a small number of high-speed Cray disks, the IBM disks provide for the bulk of the storage for small files and infrequently used files. Cray Research designed the BMC and its supporting software in the XIOP to allow IBM tapes and other devices to be attached to the X-MP. No hardware changes were necessary, and we added less than 2000 lines of code to the XIOP to accomplish this project. This system has been in operation for over eight months. Future enhancements such as the use of a cache controller and attachment to a Y-MP are also described. 1 tab.

32987 (CONF-8904219–1) **A view of the evolving DOE software copyright policy.** Butler, M.K. Argonne National Lab., IL (USA). 1989. 10p. Sponsored by DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From Atomic Energy Society of Japan meeting; Tokai-Mura, Japan; 4 Apr 1989. Order Number DE89013620/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In May of 1988, the US Department of Energy (DOE) announced a change in its policy with respect to the copyrighting of computer software by its Management and Operating (M and O) contractors. The intent of this revision is to allow the contractors to secure copyrights for all scientific and technical software funded by the Department except in those cases where such action (1) would be detrimental to national security, (2) would not enhance the appropriate transfer or commercialization of the software, (3) would have a negative impact on US industrial competitiveness, or (4) would prevent DOE from meeting its obligations under international treaties and agreements. Classified computer software and that developed with Naval Reactors funding are specifically excluded from the new policy. This paper will discuss foreseeable changes to, and the potential impacts on, the National Energy Software Center (NESC) program and the role the Center will play in implementation of the policy. The NESC was established almost thirty years ago as the Argonne Code Center, a cooperative undertaking to encourage the sharing of reactor design and engineering codes among Atomic Energy Commission contractors and the transfer of AEC computing technology to industry. A brief history of the Center and a description of its present operation will be provided as background for the author's perspective. 4 refs.

32988 (CONF-8905135–1) **An expert system for correlation of radar and passive sensor signals.** Williams, L.C.; Gamberini, R.J. Oak Ridge National Lab., TN (USA). 1989. 4p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. From DFS '89: Data Fusion symposium; Baltimore, Maryland, USA; 14 May 1989. Order Number DE89011575/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes a system for automating the correlation task by combining high-speed hardware with symbolic pattern-matching software to perform correlation of active and passive signals in real time. The first section of this paper describes the hardware and software used to implement the inference engine so that correlations can be performed in real time. The second section describes the expert system, with emphasis on the heuristics used to code the correlator efficiently. The final section describes the simulation environment under which the system is operated current efforts, and plans for further development. 2 refs., 2 figs.

32989 (CONF-8906113–2) **An expert system to facilitate selecting a database management system.** Roseberry, L.M.; Kilgore, D.C. Oak Ridge National Lab., TN (USA). 6 Jun 1989. 7p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. From DOE technical information meeting: INFOTECH; Oak Ridge, Tennessee, USA; 6-7 Jun 1989. Order Number DE89012350/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An investigation has been initiated to develop an expert system to assist information professionals in selecting a database management system (DBMS). The system attempts to consider DBMS basic design, theory, and performance standard as well as the specific needs of the project. The user is queried for needs, wants, and resource restrictions. The inference engine tests these data against its rule set and generates prioritized recommendations. The rule set design will be discussed. The usefulness of such a tool will be discussed as well as plans for its continued evolution.

32990 (CTA-EAv-ENU-FR–001/81) **Comments on MC/sup 2/-2 and MINX computer codes.** Corcuera, R.P. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais. 21 May 1981. 9p. (In Portuguese). Order Number

DE89614724/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Different cross section processing codes such as MC/sup 2/, MC/sup 2/-2, MINX e NJOY are analysed and the possible reasons for the discrepancies among the results are discussed.

32991 (CTA-IEAv-NI-CPD-SC–014/82) **Adaptation of HAMMER computer code to CYBER 170/750 computer.** Pinheiro, A.M.B.S.; Nair, R.P.K. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. 5 Aug 1982. 5p. (In Portuguese). Order Number DE89614725/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The adaptation of HAMMER computer code to CYBER 170/750 computer is presented. The HAMMER code calculates cell parameters by multigroup transport theory and reactor parameters by few group diffusion theory. The auxiliary programs, the carried out modifications and the use of HAMMER system adapted to CYBER 170/750 computer are described. (M.C.K.).

32992 (CTA-IEAv-NI-ENU–001/83) **Use of ETOG computer code for preparing the epithermal library of HAMMER with data from ENDF/B-IV.** Leite, S.B. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Feb 1983. 4p. (In Portuguese). Order Number DE89614726/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The modifications carried out in the ETOG3 computer codes used for preparating the epithermal library of HAMMER computer code with data from ENDF/B-IV, are presented. (M.C.K.).

32993 (CTA-IEAv-RI–003/83) **Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV.** Cunha Menezes Filho, A. da. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. 27 Oct 1983. 13p. (In Portuguese). Order Number DE89614728/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The modifications carried out in the ETOT-3 and ETOG-3 computer codes used for preparating the thermal (172 energy groups) and epithermal (54 energy groups) libraries, respectivelly, of LEOPARD computer code, are presented. (M.C.K.).

32994 (CTA-IEAv-RP–024/88) **Generation and tests of the new version 88 library for HAMMER system.** Chalhoub, E.S.; Anaf, J. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Aug 1988. 36p. (In Portuguese). Order Number DE89614729/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A new library, version 88, for the HAMMER system, was generated using the ENDF/B-IV FRENDL evaluated nuclear data libraries. It is composed of epithermal and thermal libraries obtained by processing the new versions of ETOG-3 and FLANGE-II codes, respectively. Test results for two benchmark critical assemblies are presented.

32995 (CTA-IEAV-RP–065/88) **Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections.** Anaf, J.; Chalhoub, E.S. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Dec 1988. 23p. (In Portuguese). Order Number DE89614730/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The NJOY and LINEAR/RECENT/GROUPIE calculational procedures for the resolved and unresolved resonance contributions and background cross sections are evaluated. Elastic scattering, fission and capture multigroup cross sections generated by these codes and the previously validated ETOG-3Q, ETOG-3, FLANGE-II and XLACS are compared. Constant weighting function and zero Kelvin temperature are considered. Discrepancies are presented and analysed.

32996 (DOE/FTR–9013613) **Technical development of HEPVM software, Paris, Lyon, France. April 17-26, 1989: Foreign trip report.** McFadden, E.J. Jr. Brookhaven National Lab., Upton, NY (USA). 10 May 1989. 128p. Sponsored by DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE89013613/JAW. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

This trip was comprised of two parts: Working technical meetings with other Computer Analysts from within the HEPVM collaboration in Paris, France. The technical discussions hosted by Roman Tirler from DPH-PE Saclay, France. Participation at the HEPVM general meeting in Lyon, France. This phase of the meeting was hosted by John O'Neall from centre de Calcul de l'IN2P3, Villeurbanne Lyon, France. This meeting is a review of what occurred at the technical meetings in Saclay.

32997 (IFVE-OASU–88-91) **PIPE-LINE feature implementation on RSx11M operating system.** Milov, P.A.; Nikitin, S.G. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij. 1988. 5p. (In Russian). Order Number DE89617496/JAW. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The software described provides the interprocess communication, named PIPE-LINE technology in UNIX. This product is realized on RSx11M operating system on PDP-11/34 and PDP-11/40 computers. Processes may communicate with related processes using the same system READ and WRITE calls that are for file system I/O. Pipe-Line technique expands the operating system facilities and provides the easier development of functional modules and the flexibility of combining them to design the processing of data flow. This software is used in the RSx11M operating system for the SM4 type computer. 5 refs.

32998 (IYaF–88-81) **Software for the Odrenok microcomputer. FORTRAN-1900.** Goncharov, V.N.; Kozak, V.R.; Nikiforov, A.A. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 49p. (In Russian). Order Number DE89614733/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The method of program compilation from the FORTRAN-1900 language by means of ILC-1900 standard compiler according to special program, monitoring addresses to external devices and ensuring link-up of the compiler with operating and file systems of the "Odrenok" microcomputer is described. Changes in the compiler, library ensuring link-up of input/output operators of compiled program with the existing systems, as well as the PIGS graphic pachage adaptation, permitting to use it in programs written in the FORTRAN-1900 language, are considered. In the supplement a description of separation with monitoring program for users is described, the FORTRAN-1900 language and certain peculiarities of inpu/outpit operations related to the change in the corresponding subprograms are briefly outlined. 100 refs.

32999 (K/DSRD–96) **Issues and approaches for electronic document approval and transmittal using digital signatures and text authentication.** Streetman, K.D.; Klein, A.J.; Hardee, J.L.; Boling, M.E. Oak Ridge Gaseous Diffusion Plant, TN (USA). 10 Feb 1989. 59p. Sponsored by DOE Defense Programs. DOE Contract AC05-84OT21400. Order Number DE89013102/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This study identifies issues and approaches to digital signature and text authentication (DS&TA) concerns for DOE-wide applications. Recommendations were derived from among the optional approaches identifiable from the literature and from known systems implementing digital signatures and text authenication. The primary issue is the adequacy of safeguards to assure signature and text authenticity.

33000 (KIYI–88-36) **Approximation of experimental dependences by two-support method.** Sokolov, A.M. AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij. 1988. 13p. (In Russian). Order Number DE89617497/JAW. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A local parametric method of approximation of experimental dependences which is stable to blanks in data and simple in realization on computer is described. Based on the information on errors in data the method allows to estimate the results of accuracy and to choose the smoothing degree automatically. The method may be used for the dependence reduction, calibration instrumentation, the drawing of smooth curves on points etc. An instruction on using of the POLAX program and the program text in FORTRAN are presented. 15 refs.

33001 (LA-UR–89-760) **The dynamical behavior of classifier systems.** Forrest, S.; Miller, J.H. Los Alamos National Lab., NM (USA). 10 Feb 1989. 16p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-890693–1: 3. international conference on genetic algorithms, Washington, D.C., USA, 4-7 Jun 1989). Order Number DE89009407/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Classifier systems are quite complicated, in terms of both their components and behavior. This complexity is understandable given the wide spectrum of activity they are intended to model. Unfortunately, the complexity of these systems also makes it difficult to understand them analytically. Previous analysis has focused on specific components of the classifier system, for example, the genetic algorithm or the bucket brigade. The lack of a unified theory has led users of these systems to rely on ad hoc methods for choosing representations and parameter settings. Recent results (Riolo, 1988) indicate that classifier systems can be very sensitive to particular encodings and parameter choices. In this paper, we propose a methodology for studying the interactions among various components of the classifier system architecture.

33002 (LA-UR–89-1511) **VMS [Virtual Memory Systems] ALAP [Audit Log Analysis Package] 1.0: An automated audit trail analysis tool.** Martinez, D.P. Los Alamos National Lab., NM (USA). 1989. 12p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-890590–7: DOE computer security conference, Amarillo, Texas, USA, 2-4 May 1989). Order Number DE89012593/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Because multiuser computer systems typically record enormous quantities of information about user and system activities into system log files, auditing computer user/system activities is a formidable task. Recognizing that a manual audit of these log files is difficult and usually ineffective, the DOE Center for Computer Security has developed an automated audit trail analysis tool, Audit Log Analysis Package (ALAP). ALAP employs methodology developed at Los Alamos National Laboratory for the detection and analysis of anomalous data in large databases. ALAP is capable of processing vast amounts of audit data for detection and analysis of anomalous computer user and system behavior. The first application tool is VMS ALAP 1.0, targeted for Digital Equipment Corporation (DEC) Virtual Memory Systems (VMS). 2 refs.

33003 (LA-UR–89-1693) **Xcl—A family of programming language-based shells.** Roschke, M.A. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8904210–5: Cray user's group conference, Los Angeles, California, USA, 24-28 Apr 1989). Order Number DE89013442/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

As the three major UNIX shells have emerged, they have shown little inclination to include syntax and semantics from existing programming languages. The first of these shells, sh, contains only a small amount of C-like syntax. Csh provides some C language expression syntax, but includes very little other C syntax. The newest of these shells, ksh, also includes some C-like expression syntax, although they contain some significantly un-C-like syntax in such areas as relational and logical operators. Several much less widely used shells have been written that much more closely resemble particular programming languages. However, each of these shells have the disadvantage of not being based upon a widely used programming language. In addition, interactive commands tend to be difficult to enter because they must frequently be entered using normal programming language constructs such as function calls. Thus, the vast majority of programmers of today's UNIX shells must deal with a shell interface that is not based upon any familiar programming language. This paper describes some of the features of the xcl family of shells. Each of these shells is based closely upon an existing programming language and provides the user with a familiar and highly programmable shell interface. 7 refs.

33004 (LA-UR–89-1832) **Change Control of software at LANL.** Coleman, J.B.; Pfaff, R.T.; Cohen, M.F. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8904210–3: Cray user's group conference, Los Angeles, California, USA, 24-28 Apr 1989). Order Number DE89013264/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Change Control is the process by which the Computing and Communications Division (C Division) at Los Alamos National Laboratory (LANL) updates software and hardware used by its customers. This paper concentrates on the control of changes to user-level software, such as languages, libraries, and utilities. It describes how these changes are documented and how automated tools have been and are being incorporated into the change control procedures to improve efficiency. 5 figs.

33005 (NBI-HE–88-80) **Error estimates on averages of correlated data.** Flyvbjerg, H.; Petersen, H.G. Niels Bohr Inst., Copenhagen (Denmark). Dec 1988. 16p. Order Number DE89775043/JAW. Available from NTIS (US Sales Only), PC A03/MF A01.

We describe how the true statistical error on an average of correlated data can be obtained with ease and efficiency by a renormalization group method. The method is illustrated with numerical and analytical examples, having finite as well as infinite range correlations.

33006 (OEVS-Mitteilung–1988, pp. 333-337) **Possible application of fuzzy set theory to radiation protection and risk assessment.** Nishiwaki, Y. (Kinki Univ., Higashi-Osaka, Osaka (Japan). Atomic Energy Research Inst.). Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria). Nov 1988. (CONF-860969–: 4. European congress and 13. regional congress of the International Radiation Protection Association, Salzburg, Austria, 15-19 Sep 1986). In *4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook.* Order Number DE89613806/JAW. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

In radiation protection and risk assessment human factors play an important role. Human reliability and performance would be affected by many factors: medical, physiological and psychological, etc.. The uncertainty involved in human factors may not necessarily be probabilistic, but fuzzy. Possible application of fuzzy set theory to radiation protection and risk assessment is discussed in this paper with the introduction of the concept of possibility. 5 refs.

33007 (ORNL/TM–11068) **A remote host facility for Intel hypercubes.** Dunigan, T.H. Oak Ridge National Lab., TN (USA). Apr 1989. 16p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89012912/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The structure and use of a remote host facility for controlling application programs on an Intel hypercube are described. The facility permits an alternate UNIX host, such as a graphics workstation or supercomputer, connected by a TCP/IP network to the Intel cube manager processor to communicate with application programs running on the hypercube nodes. The facility supports both C and FORTRAN applications. 5 refs., 1 fig., 2 tabs.

33008 (ORNL/TM–11079) **Evaluation of the IBM token-ring network via the proposed standard wiring plan.** Glassell, J.T. Oak Ridge National Lab., TN (USA). Apr 1989. 33p. Sponsored by DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE89012920/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When installing a local area network (LAN), one of the decisions that must be made is the type of cabling to use. The choice is among twisted-pair, coaxial, or fiber optic cables. Each type has trade-offs. Twisted-wire cable's advantages over coaxial cable are its light weight, small size, flexibility, relative inexpensiveness, and ease of installation. Disadvantages include its lower bandwidth and installer's inexperience with it. Twisted pair, however, can be used in a modular wiring scheme, which makes for easy and safe portability. This report covers the results of a test of the IBM token-ring network, which communicates via a modular wiring scheme by using unshielded twisted pairs as its medium, to determine at what cable length token-ring network performance would degrade. Test configurations and results are reported, and recommendations specific to IBM token-ring equipment operation are made. Note: A companion report (ORNL/TM-11080) covers the results of tests with Ethernet twisted-pair products. 7 refs., 12 figs., 5 tabs.

33009 (SAND–88-0173) **System-based component test plans and operating characteristics: Introduction and overview.** Easterling, R.G.; Spencer, F.W.; Diegert, K.V.; Mazumdar, M. Sandia National Labs., Albuquerque, NM (USA). May 1989. 22p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89012255/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Component test plans are often designed by allocating system reliability among the system's components, then choosing individual component plans suitable for demonstrating achievement of each component's reliability goal. This approach does not consider how much information relative to the system reliability goal is provided by the ensemble of component tests. We propose and develop the notion of system reliability O.C. curves, based on the component tests, and illustrate their use in designing or evaluating an overall test program. By specifying O.C values (akin to producer's and consumer's risks), optimum, system-oriented component test plans can be derived. These ideas are illustrated in this paper for a series system and for a simple series-parallel system, with binomial data. These and other system configurations and data structures will be considered in more detail in later reports. 7 refs., 10 figs., 2 tabs.

33010 (SAND–88-3016) **Imagine: A TACS [Test Analysis Computing System] interactive imaging system.** Haynes, R.A. Sandia National Labs., Albuquerque, NM (USA). Feb 1989. 38p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE89012815/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Sandia National Laboratories Test Analysis Computing System (TACS) acquires, reduces, and analyzes test data produced from environmental and developmental testing. In 1983, a Comtal image processing system was acquired to provide a capability for digitizing and processing visual data. Due to the complex user interface of the Comtal and application specific software, capabilities of this system have not been fully utilized and TACS image processing functionality has been limited. To provide a flexible, easy-to-use interactive system which produces data that can readily be accessed from other TACS software, an imaging software package (Imagine) was developed. This paper describes the user interface and functions implemented in Imagine. The rationale for using each function is given to show when it is applicable, and examples are given to show how the functions operate. 15 refs.

33011 (UCID–21622) **The CALS Test Network MIL-D-28000 Class II reference drawing packet: Revision C.** Lawrence Livermore National Lab., CA (USA). 27 Jan 1989. 152p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE89012246/JAW. Available from NTIS, PC A08/MF A01 - OSTI.

This CALS Test Network MIL-D-28000 Class II Reference Drawing Packet contains the information needed to conduct tests of the engineering drawing subset, Class II, of the military specification MIL-D-28000 using IGES processors. The material is intended to demonstrate industry's and government's use of MIL-D-28000 in accordance with the CALS initiative. The CALS Test Network (CTN) is the organization tasked with demonstrating this digital data interchange among industry and government and will use this packet during CTN structured testing. The results derived from this testing will allow the CTN to suggest modifications to drafting techniques, CAD vendors' IGES processors, the IGES specification, and most importantly, the MIL-D-28000 military specification.

33012 (UCRL–100156) **A simple method to remove reference counting in applicative programs.** Skedzielewski, S.K.; Simpson, R.J. Lawrence Livermore National Lab., CA (USA). 23 Nov 1988. 11p. Sponsored by DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-890654–2: Conference on programming language design and implementation, Portland, Oregon, USA, Jun 1989). Order Number DE89006739/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The efficient compilation of applicative languages that contain data structures such as arrays or records may require that the compiler use a dynamic memory allocator for structured objects. If so, the overhead of reference counting in applicative langauges can be considerable, if a compiler simply adds code for reference counting to each operations that references an object. Fortunately , not all the reference counting is necessary for correctness. This paper discusses the use of data dependence information to statically remove reference counting operations. In addition, this method preserves all of the parallelism that was present in the original code and, in some cases, points out opportunities where structured objects can be destructively reused (updated-in-place). 10 refs., 5 figs.

33013 (UCRL–101060) **The challenge of change for Fortran.** Adams, J.; Martin, J. Lawrence Livermore National Lab., CA (USA). 26 Apr 1989. 1p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8904210–2: Cray user's group conference, Los Angeles, California, USA, 24-28 Apr 1989). Order Number DE89012370/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

FORTRAN/modifications; FORTRAN; MODIFICATIONS; CRAY COMPUTERS

33014 A simple microprocessor for FASTBUS slave modules. Meyer, W. T. (Ames Laboratory, Ames, Iowa 50011(US)); Gorbics, M. S. *Computers in Physics (USA),* 3(4): 73-77 (Jul 1989).

A simple but powerful implementation of a microprocessor is described foruse as an embedded processing engine in FASTBUS modules. This design uses a 16MHz 68000 processor and 128K of static random access memory, yet it iseconomical enough for use on boards which are produced in large quantities. Thecircuit contains 11 chips, draws less than 4 W of power, and costs less than $75in parts. Software can be written using any assembler or compiler/linker whichcan create Motorola S-code or an absolute binary image, and several tools existto aid software development.

33015 Simplified anti-submarine warfare problem treated as a steady state Markov process. Marsh, G.E. (Argonne National Lab., IL (USA)); Piacesi, R. *Applied Physics Communications (USA),* 8(4): 227-238 (Dec 1988).

There is a growing interest in the physics community in questions related to strategic nuclear force survivability. Markov processes represent a powerful method for quantifying such questions. In this paper the authors give an elementary introduction to Markov processes and chains followed by a simple anti-submarine warfare example in which the scenario of a surveillance-surge attack is treated as a steady state Markov process.

33016 Incomplete iterations in multistep backward difference methods for parabolic problems with smooth and nonsmooth data. Bramble, J. H. (Cornell University Ithaca, New York 14853(US)); Pasciak, J. E.; Sammon, P. H.; Thomee, V. *Mathematics of Computation (USA),* 52(186): 339-367 (Apr 1989). DOE Contract AC02-76CH00016.

Backward difference methods for the discretization of parabolic boundary value problems are considered in this paper. In particular, we analyze the case when the backward difference equations are only solved 'approximately' by a preconditioned iteration. We provide an analysis which shows that these methods remain stable and accurate if a suitable number of iterations (often independent of the spatial discretization and time step size) are used. Results are provided for the smooth as well as nonsmooth initial data cases. Finally, the results of numerical experiments illustrating the algorithms' performance on model problems are given.

33017 Nonnegativity-, monotonicity-, or convexity-preserving cubic and quintic hermite interpolation. Dougherty@f—, R. L. (Center for Nonlinear Studies(US)); Edelman@f—, A.; Hyman, J. M. *Mathematics of Computation (USA),* 52(186): 471-494 (Apr 1989). DOE Contract W-7405-ENG-36.

The Hermite polynomials are simple, effective interpolants of discrete data. These interpolants can preserve local positivity, monotonicity, and convexity of the data if we restrict their derivatives to satisfy constraints at the data points. This paper describes the conditions that must be satisfied for cubic and quintic Hermite interpolants to preserve these properties when they exist in the discrete data. We construct algorithms to ensure that these constraints are satisfied and give numerical examples to illustrate the effectiveness of the algorithms on locally smooth and rough data.

33018 Convergence of a random walk method for the Burgers equation. Roberts, S. (Centre for Mathematical Analysis Australian National University GPO Box 4 Canberra ACT 2601,

Australia(AU)). *Mathematics of Computation (USA)*, 52(186): 647-673 (Apr 1989).

We show that the solution of the Burgers equation can be approximated in $L^1(\mathbf{R})$, the within $O(m^{-1/4}(\ln m)^2)$, by a random walk method generated by $O(m)$ particles. The nonlinear advection term of the equation is approximated by advecting the particles in a velocity field induced by the particles. The diffusive term is approximated by adding an appropriate random perturbation to the particle positions. It is also shown that the corresponding viscuous splitting algorithm approximates the solution of the Burgers equation in $L^1(\mathbf{R})$ to within $O(k)$ when k is the size of the time step. This work provides the first proof of convergence in a strong sense, for a random walk method, in which the related advection equation allows for the formation of shocks.

33019 Convergence of a random particle method to solutions of the Kolmogorov equation $u_t=\nu u_{xx}+u(1-u)$. Puckett, E. G. (Lawrence Livermore National Laboratory P.O. Box 808(US)). *Mathematics of Computation (USA)*, 52(186): 615-645 (Apr 1989). DOE Contract AC03-76SF00098;W-7405-ENG-48.

We study a random particle method for solving the reaction-diffusion equation $u_t=\nu u_{xx}+f(u)$ which is a one-dimensional analogue of the random vortex method. It is a fractional step method in which $u_t=\nu u_{xx}$ is solved by random walking the particles while $u_t=f(u)$ is solved with a numerical ordinary differential equation solver such as Euler's method. We prove that the method converges when $f(u)=\psi(1-u)$, i.e. the Kolmogorov equation, and that when the time step Δt is $O(\sqrt[4]{N^{-1}})$ the rate of convergence is like $\ln N.\sqrt[4]{N^{-1}}$ where N denotes the number of particles. Furthermore, we show that this rate of convergence is uniform as the diffusion cofficient ν tends to 0. Thus, travelling waves with arbitrarily steep wavefronts may be modeled without an increase in the computational cost. We also present the results of numerical experiments including the use of second-order time discretization and second-order operator splitting and use these results to estimate the expected value and standard deviation of the error.

9903 Information Handling

Refer also to citation(s) 30980, 32174, 32353, 32966, 32981

33020 (NRC/BR–387) **The development of services for the transfer of technical information on building.** Handegord, G.O. National Research Council of Canada, Ottawa, ON (Canada). Div. of Building Research. 1973. 9p. (CONF-7206120–: Meeting on CIB W 52: Subgroup 1, Stockholm, Sweden, 19-20 Jun 1972;CE–02558). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum.

The influences of initial policies and subsequent operational experience on the development of information resources, publications and communications techniques by the Division of Building Research, National Research Council of Canada during its first twenty-five years are outlined. The present characteristics of the organization are discussed as representative of an information analysis centre integrated with a mission-oriented research agency and related to other scientific and technical information agencies in Canada.

33021 (ORNL/CDIAC–26) **Data Inventory System (DIS): A user's guide and programmer's manual.** Harper, J.B.; Fowler, D.E. Oak Ridge National Lab., TN (USA). Carbon Dioxide Information Analysis Center. Apr 1989. 58p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89012911/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Environmental Sciences Division Publication No. 3200.

This manual provides information about system requirements, installation and setup, and how to use the Data Inventory System (DIS). It is intended as both a user's guide and as documentation for programmers who may need to revise the system as information needs change. This system eliminates the need to revise the Data Base Inventory assembled by Boden since DIS will be continually updated. DIS is a reference system of databases important to the Carbon Dioxide Research Program. It contains descriptive information about the databases and information about where the files are stored at CDIAC. Because much of the information is only of value to CDIAC staff, DIS reports are not published for public distribution.

33022 (SAND–89-0095C) **Prepositioned shared secret and/or shared control schemes.** Simmons, G.J. Sandia National Labs., Albuquerque, NM (USA). 1989. 32p. Sponsored by DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8904218–1: Eurocrypt '89, Houthalen, Belgium, 11-13 Apr 1989). Order Number DE89012568/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This is the third in a series of papers devoted to the analysis and realization of much extended capabilities for shared secret and/or shared control schemes over and above what can be achieved by simple (k,l)-threshold schemes. Since an essential first step has been to understand as clearly as possible the underlying principles on which shared control is based, all of the papers – this one included – have also been concerned with the formulation of a simple unifying model of sufficient generality to encompass all of the extensions. 53 refs.

33023 (SAND–89-0909C) **Documentation for users: Audience, content, and language.** Poore, A.V. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-890610–3: ASES annual meeting and 14th annual passive solar conference, Denver, Colorado, USA, 19-23 Jun 1989). Order Number DE89009978/JAW. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

When a technology such as solar energy enters the everyday world, the documentation about it must also become part of the technology transfer. The challenge in creating publications about technical subjects for semi-technical people or for popular use is to be both accurate and interesting. The process of creating this documentation should begin by carefully defining the audience and aiming the publication at it. To a large extent, the audience determines both the content and the language that will be used. 2 refs.

33024 (UCID–21677) **Engineering drawing transfer test with Douglas Aircraft Company: MIL-D-28000 Class II (IGES).** Lawrence Livermore National Lab., CA (USA). 2 May 1989. 35p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE89012810/JAW. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The DoD Computer-aided Acquisition and Logistic Support (CALS) Test Network (CTN) is conducting tests of the military standard for the Automated Interchange of Technical Information, MIL-STD-1840A (1840A) [OSDA88] and its companion suite of military specifications. The CTN is a DoD sponsored confederation of voluntary participants from industry and Government, managed jointly by a technical staff at Air Force Logistics Command (AFLC) and Lawrence Livermore National Laboratory (LLNL). The objective of the CTN tests is to demonstrate and evaluate the interchange and functional use of digital technical information between industry and government using the CALS Standards. This test was CTN Planned Test (CPT) [CTN89] with Douglas Aircraft Company (DAC). It was conducted at a DAC facility in Long Beach, California, February 7-9, 1989. The objective of the CPT was to test the engineering drawing subset of Initial Graphics Exchange Specifications (IGES) [NBS88] entities defined in the Military Specifications for the Digital Representation for Communication of Product Data: IGES Application Subsets, MIL-D-28000 Amendment 1 (28000) [OSDD88]. Since DAC is preparing to accept data from a subcontractor in conjunction with its DoD C17 contract, the primary goal of this test was to demonstrate, test, secondary goal was to evaluate the CTN's 28000 Class II Reference Material utilized for the first time in this test and scheduled for use in subsequent tests of 28000. 9 refs., 6 figs., 2 tabs.

9905 Civilian Defense

Refer also to citation(s) 32930, 32931

33025 (LA–11506-PR) **Physics Division progress report, October 1, 1986–September 30, 1987.** Shera, E.B. (comp.); Sowerwine, H. (ed.). Los Alamos National Lab., NM (USA). May 1989. 162p. Sponsored by DOE/DP;DOE/ER. DOE Contract W-7405-ENG-36. Order Number DE89013334/JAW. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This report provides brief accounts of significant progress in development activities and research results achieved by Physics Division personnel during the period October 1, 1986 through September 30, 1987. These efforts are representative of the three main areas of experimental research and development in which the Physics Division serves Los Alamos National Laboratory's and the nation's needs in defense and basic sciences: defense physics, including the development of diagnostic methods for weapons tests, weapon-related high-energy-density physics, and programs supporting the Strategic Defense Initiative; laser physics and applications, especially to high-density plasmas; and fundamental research in nuclear and particle physics, condensed-matter physics, and biophysics. Throughout the report, emphasis is placed on the design, construction, and application of a variety of advanced, often unique, instruments and instrument systems that maintain the Division's position at the leading edge of research and development in the specific fields germane to its mission.

33026 (LA–11557-MS) **Directed energy weapons–lasers: Ground- and space-based systems.** Canavan, G.H. Los Alamos National Lab., NM (USA). Jun 1989. 32p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89012804/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Directed energy weapons (DEWs) range and speed complement kinetic energy weapons (KEWs) lethality and offset their sensitivity to launch area and time. Lasers could be developed to the power and brightness required to offset the degradation of KEWs by advanced threats. This report reviews their scaling, discusses how they could extend the effectiveness of KEW systems, and estimates when they could enter the defenses. 32 refs., 7 figs.

33027 (LA–11573-MS) **Constellation sizing for modest directed energy platforms.** Canavan, G.H. Los Alamos National Lab., NM (USA). Jun 1989. 9p. Sponsored by DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE89012826/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Discussions of boost-phase, directed energy scaling have concentrated on large lasers and mirrors requiring development. This report explores modest lasers that could be deployed sooner if their performance and effectiveness were found to be adequate. 6 refs., 3 figs.

33028 (ORNL/TM–11143) **Shield optimization program, Part I: Executive summary.** Santoro, R.T.; Gabriel, T.A. Oak Ridge National Lab., TN (USA). Jun 1989. 43p. Sponsored by Department of Defense. DOE Contract AC05-84OR21400. Order Number DE89013335/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Detailed studies have been completed to estimate the radiation-induced damage in sensitive electronic components carried on a space-based interceptor weapons platform. The architecture of the interceptor was devised to be as realistic as possible. The analyses were completed for natural (Van Allen belt protons and electrons at an orbital altitude of 500 km) and man-made (nuclear weapons: neutrons, gamma-rays, X-rays, and pumped electron belts) radiation expected to be encountered by a SDI platform. Studies have also been completed to determine the hydrodynamic responses of beryllium mirror surfaces to mono-energetic X-rays (1 and 2 keV). This work included the effects of impurities which are introduced into the surface during machining. Finally, a comparison of the HULL and PUFF-TFT codes are presented which includes the thermo-mechanical response of an Al slab to 5 keV black body radiation. 16 refs., 12 figs., 10 tabs.

33029 (ORNL/TM–11160) **Shield optimization program: Part 5, A hydrodynamic comparison using HULL and PUFF-TFT for a one-dimensional aluminum slab.** Smith, M.S.; Burns, T.J.; Johnson, J.O. Oak Ridge National Lab., TN (USA). Jun 1989. 27p. Sponsored by DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE89013321/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Results from the PUFF-TFT code were compared with those from HULL for a 1 dimensional aluminum slab subjected to X-rays from a 5 keV blackbody source. The source spectra was equivalent to a 1.5 Megaton thermonuclear device detonated at a distance of 10 km. Code predictions of density, internal energy, fracture locations, and axial stress were examined. With the exception of the magnitude of the axial stress results from both codes were in agreement as to the characteristics of the material response. 8 refs., 16 figs., 1 tab.

33030 (UCID–21701) **Preliminary assessment of the impact of incorporating a detailed algorithm for the effects of nuclear irradiation on combat crew performance into the Janus combat simulation.** Warshawsky, A.S.; Uzelac, M.J.; Pimper, J.E. Lawrence Livermore National Lab., CA (USA). May 1989. 13p. DOE Contract W-7405-ENG-48. Order Number DE89013322/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Crew III algorithm for assessing time and dose dependent combat crew performance subsequent to nuclear irradiation was incorporated into the Janus combat simulation system. Battle outcomes using this algorithm were compared to outcomes based on the currently used time-independent "cookie-cutter" assessment methodology. The results illustrate quantifiable differences in battle outcome between the two assessment techniques. Results suggest that tactical nuclear weapons are more effective than currently assumed if performance degradation attributed to radiation doses between 150 to 3000 rad are taken into account. 6 refs., 9 figs.

33031 (UCRL–100789) **Atmospheric effects on laser propagation.** Karr, T.J. Lawrence Livermore National Lab., CA (USA). 16 Mar 1989. 10p. Sponsored by Department of Defense. DOE Contract W-7405-ENG-48. (CONF-890145–25: SPIE conference on optics, electro-optics and laser applications in science and engineering: OE/LASE '89, Los Angeles, California, USA, 15-20 Jan 1989). Order Number DE89012287/JAW. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The linearized theory of thermal blooming instabilities is reviewed. The dispersion relation is derived for unstable modes with and without correction. Perfect phase-only correction is unstable at all spatial scales, while perfect field conjugation is stable at all scales. Various atmospheric phenomena such as turbulence, diffusion and wind shear may mitigate or dampen the instabilities. Full nonlinear time-dependent computer simulations of laser atmospheric propagation agree with the dispersion relation for small perturbations, and show saturation and nonlinear mode beating at long times. 2 refs., 7 figs.

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in *DOE Energy Data Base: Corporate Author Entries* (DOE/TIC-4585). Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, also abbreviated; and (3) the language of the document if non-English (R;US;In French). Author affiliations are not listed in this index.

A

Aalborg Universitetscenter (Denmark). Inst. for Bygningsteknik
Probabilistic design of offshore structural systems, 14:31686 (R;DK)

Academia de Ciencias do Estado de Sao Paulo, SP (Brazil)
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)

Acres Consulting Services Ltd., Niagara Falls, ON (Canada)
Energy storage on the supply side or the demand side, 14:30927 (R;CA)

Acres International Corp., Amherst, NY (USA)
Report on modular hydropower demonstration, 14:30677 (R;US)

Acurex Corp., Research Triangle Park, NC (USA). Environmental Systems Div.
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 3, January 1, 1989–March 31, 1989, 14:30274 (R;US)

Acurex Corp., Research Triangle Park, NC (USA). Southeast Regional Office
N_2O field study. Final report, 14:30810 (R;US)

ADM Associates, Inc., Sacramento, CA (USA)
Market study of commercial appliances: Volume 1, Assessment of commercial appliance efficiency improvements: Final report, 14:31059 (R;US)

AENCO, Inc., Minnetonka, MN (USA)
Evaluation of rotary-drum air classification of shredded and unshredded municipal solid waste. Final report, 14:31149 (R;US)

Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.
Radiation dose in a Molniya-type orbit. Technical report, 14:32746 (R;US)

Agence Francaise pour la Maitrise de l'Energie, 75 - Paris
Proceedings of the France - Korea 2. Joint Seminar on energy conservation vol. 1 et 2, 14:31106 (R;FR)

Agency for International Development, Washington, DC (USA)
Power shortages in developing countries: magnitude, impacts, solutions, and the role of the private sector: a report to Congress, 14:31033 (R;US)

Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA)
Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988, 14:31988 (R;US)

Akademie der Landwirtschaftswissenschaften der DDR, Schlieben-Bornim (German Democratic Republic). Forschungszentrum fuer Mechanisierung der Landwirtschaft
Radiometric weighing devices. Part 1 and 2. Fundamentals, design, and applications, 14:30648 (R;DD;In German)

Alabama Univ., Huntsville, AL (USA)
Transverse momentum distributions and particle correlations from EMU05, 14:32680 (R;US)

Alaska Univ., Fairbanks (USA). Water Research Center
Fiscal Year 1987 program report: Alaska Water Research Center, 14:32075 (R;US)

Alberta Energy, Edmonton, AB (Canada). Scientific and Engineering Services and Research Div.
Some energy-saving measures for commercial buildings, 14:31054 (R;CA)

Alberta Public Utilities Board, Edmonton, AB (Canada)
Gas supply and transportation services inquiry, 14:30318 (R;CA)

Alberta Research Council, Edmonton, AB (Canada)
Alberta Research Council [research reports], 14:30372 (R;CA)

Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept.
Batch autoclave testing of subbituminous coals of Alberta. Carbon monoxide/steam and dispersed catalyst process, 14:30242 (R;CA)
Batch autoclave tests for the liquefaction of Alberta subbituminous coals: I.G. Farben liquefaction process, 14:30241 (R;CA)
Liquefaction characteristics of Highvale coal in the Dow Coal Liquefaction Process, 14:30243 (R;CA)
Review of the literature on experimental studies of the pyrolysis and hydropyrolysis of coal, 14:30244 (R;CA)
Round robin tests, 1982. Petrographic analysis for a high volatile Australian coal and its liquefied residue, 14:30269 (R;CA)

Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada)
Alberta Research Council [research reports], 14:30371 (R;CA)
Some energy-saving measures for commercial buildings, 14:31054 (R;CA)

Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.
Annual site environmental report for calendar year 1988, United States Department of Energy, Kansas City Plant, Kansas City, Missouri, 14:31927 (R;US)

Alternative Resources, Inc., Concord, MA (USA)
Resource recovery facility siting: Recommendations for economic and other equity adjustments: Final report, 14:31039 (R;US)

American Coll. of Nuclear Physicians, Washington, DC (USA)
American College of nuclear physicians committee to review the facilities report: 1988 edition, 14:32363 (R;US)

American Statistical Association, Alexandria, VA (USA)
ASA conference on radiation and health: Coolfont 7: Final report, 14:32370 (R;US)

American Statistical Association, Washington, DC (USA)
ASA conference on radiation and health, Coolfont VI: Final report, 14:32369 (R;US)

Amsterdam Univ. (Netherlands)
Two-body electrodisintegration of /sup 4/He studied through the (e,e'X) reaction, 14:32652 (R;NL)

AN Kazakhskoj SSR, Alma-Ata (USSR). Inst. Fiziki Vysokikh Ehnerglj
Gauge invariant gravitation theory. 1. Gravitational field source and spin, 14:32632 (R;SU;In Russian)
On interpretation of the magnetic charge effect on ferromagnetic aerosols, 14:32585 (R;SU)
Vibrational spectra of hydrogen containing centers in crystalline silicon, 14:32799 (R;SU;In Russian)

AN Latvijskoj SSR, Riga (USSR). Inst. Fiziki
Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)

AN SSSR, Moscow (USSR)
Neutron physics. Vol. 2, 14:32647 (R;SU;In Russian)

AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki
100-kJ microsecond REB transport in a one-meter solenoid, 14:32921 (R;SU;In Russian)

Definition of adiabaticity of nonparaxial magnetic mirror, 14:32875 (R;SU;In Russian)
Does static solution exist for a gravitating flat wall, 14:32825 (R;SU)
Effect of magnetic system errors on the transport processes in long solenoids, 14:32920 (R;SU;In Russian)
Experiments on investigation of angular characteristics of power microsecond REB, 14:32874 (R;SU;In Russian)
Intermediate statistics of quasienergy spectrum and quantum localization of classical chaos, 14:32826 (R;SU;In Russian)
Ion source with increased service life, 14:31748 (R;SU;In Russian)
Negative differential resistance of electron diode in magnetic field, 14:31717 (R;SU;In Russian)
Negative energy waves in magnetic flux tubes, 14:32876 (R;SU)
Negative ion production in pure-hydrogen discharges of surface plasma, 14:32918 (R;SU;In Russian)
Negative ion surface-plasma source for plasma trap injectors development in Novosibirsk, 14:32919 (R;SU;In Russian)
On geometric focusing of negative hydrogen ions in surface-plasma sources, 14:31747 (R;SU;In Russian)
On stochastic quantization, 14:32827 (R;SU;In Russian)
Software for the Odrenok microcomputer. FORTRAN-1900, 14:32998 (R;SU;In Russian)
Study on pulse characteristics of belt magnetic circuits made of thin transformer steel, 14:31749 (R;SU;In Russian)
Theory of ion deceleration in magnetized temperature-anisotropic electron plasma, 14:31718 (R;SU;In Russian)

AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki
Chiral symmetry breaking and nonperturbative scale anomaly in gauge field theories, 14:32617 (R;SU)
Correlations between dilepton yields and pion multiplicities as probe of the deconfinement transition, 14:32704 (R;DE)
Deconfinement analysis in exactly solvable model of lattice QCD in strong coupling approximation, 14:32631 (R;SU)
Electron in an external magnetic field: boundary conditions, anomaly and index, 14:32630 (R;SU;In Russian)
Geometrical model of multiple production, 14:32586 (R;SU)
Lepton pair emission as a probe for space-time scenario of quark-hadron phase transition, 14:32733 (R;SU)
Measurement of rho(S)=ReT(S,O)/ImT(S,O) at the collider and its interpretation in a model with odd-c exchange, 14:32588 (R;SU)
Polarized photons from quark-gluon plasma, 14:32587 (R;SU)
Study on the /sup 3/H + α and /sup 3/He + α elastic scatterings in a state with zero orbital moment, 14:32734 (R;SU)

AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij
Angular distribution of alpha particle flux on the first wall of a tokamak, 14:32879 (R;SU;In Russian)
Approximation of experimental dependences by two-support method, 14:33000 (R;SU;In Russian)
Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)
Low-background setup for the investigation of rare processes of nuclear decay, 14:31818 (R;SU;In Russian)
Neutron physics. Vol. 2, 14:32647 (R;SU;In Russian)
On canonical quantization of the electromagnetic field in terms of field strengths, 14:32633 (R;SU;In Russian)
On theory of stability of flute modes in a tokamak with β/sub e/ $\simeq$ 1, 14:32877 (R;SU;In Russian)
On-line measurement system of multidimensional spectra with real time digital preprocessing of experimental information, 14:31819 (R;SU;In Russian)
Position-sensitive detector for local plane of the beta-spectrometer, 14:31822 (R;SU;In Russian)
Precision impulse generator for stabilization of a semiconductor spectrometer, 14:31821 (R;SU;In Russian)
Processes of inelastic collision of composite particles with non-spherical nuclei, 14:32736 (R;SU;In Russian)
Rastr-RT interactive graphics system for real time tasks, 14:31820 (R;SU;In Russian)
Stable current-to-frequency converter for charged particle beam monitoring, 14:31751 (R;SU;In Russian)
Study of cooperative processes in polymer gels by the method of slow neutron transmission, 14:32800 (R;SU;In Russian)
Study on isomeric ratios in the /sup 45/Sc(γ,n)/sup 44mg/Sc and /sup 44/Ca(p,n)/sup 44mg/Sc reactions, 14:32666 (R;SU;In Russian)
Variation methods in the theory of the plasma bunches oscillations, 14:32878 (R;SU;In Russian)

Analytical Assessments Corp., Marina Del Rey, CA (USA)
PACOM net assessment: Pakistani and Indian nuclear perceptions. Volume 1. Main report. Final report, 31 January-31 August 1983, 14:31170 (R;US)

Applied Physics Systems, Mountain View, CA (USA)
Development of a magnetic coating for gas pipe detection. Final report, May 1987-June 1988, 14:30322 (R;US)

Arctec Canada Ltd., Kanata, ON (Canada)
Design and construction of automated freeze-thaw testing equipment for concrete. Final report, 14:31663 (R;CA)

Argonne National Lab., Idaho Falls, ID (USA)
The relationship between integral experimental data and nuclear fission parameters, 14:30857 (R;US)

Argonne National Lab., IL (USA)
A view of the evolving DOE software copyright policy, 14:32987 (R;US)
Amorphization of Zr_3Al by hydrogenation and subsequent electron irradiation, 14:31185 (R;US)
An improved phase-control system for superconducting low-velocity accelerating structures, 14:31692 (R;US)
ANL electrochemical program for DOE/EHP: Quarterly technical progress report for April through June 1988, 14:30961 (R;US)
ANL site response for the DOE FY1991 information technology resources long-range plan, 14:32981 (R;US)
Application of neutron diffraction to the measurement of internal residual strain in the constituents of advanced composites, 14:31316 (R;US)
Applications of ion beam processes in tribology, 14:31187 (R;US)
Attaching IBM-compatible 3380 disks to Cray X-MP, 14:32986 (R;US)
Attractive levitation for high-speed ground transport with large guideway clearance and alternating-gradient stabilization, 14:31593 (R;US)
Combined SO_2/NO_x control technologies, 14:30271 (R;US)
Composition of superconducting $La_2CuO_{4+\delta}$: A superconductor doped by excess oxygen defects, 14:31270 (R;US)
Development of magnetic resonance imaging technology for imaging binder distribution in ceramics, 14:31272 (R;US)
Development of Radhard VLSI electronics for SSC calorimeters, 14:31800 (R;US)
Electrochemical reactions in submerged arc welding with SiO_2-CaO-CaF_2 fluxes with high and low silica contents, 14:31274 (R;US)
Electrochemical transport of manganese between the flux and the weld metal in submerged arc welding, 14:31275 (R;US)
Environmental aspects of rights-of-way for natural gas transmission pipelines: An updated bibliography: Final report, September 1987–June 1988, 14:30321 (R;US)
Erosion of Al and Al/SiC, 14:31269 (R;US)
Evolution of the liquid metal reactor: The Integral Fast Reactor (IFR) concept, 14:30849 (R;US)
Expediting cleanup at the Weldon Spring site under CERCLA and NEPA, 14:32026 (R;US)
Fission theory: Its relevance to the nuclear cross section data base, 14:32696 (R;US)
Friction-reducing additive scale-up experiments in a pilot-scale DHC system simulator, 14:31136 (R;US)
Future applications of engine ceramics: Factors influencing market opportunities, timing, and growth, 14:31157 (R;US)
Gas generation from the irradiation of mortar, 14:30524 (R;US)
Heavy-ion superconducting linacs, 14:31693 (R;US)
High-resolution electron microscopy of metal/ceramic interfaces, 14:31186 (R;US)
High-temperature behavior of grain boundaries from embedded atom method molecular dynamics simulation, 14:31188 (R;US)
Identification and evaluation of SERI-NF1 fungus for ethanol production from xylose fermentation, 14:30654 (R;US)
LAMPF E645/current status, 14:32546 (R;US)

Legal aspects of implementing a global chemical weapons convention under domestic laws, 14:31169 (R;US)
Measurement and fitting of pulse shapes of moderators at IPNS [Intense Pulsed Neutron Source]: Progress report, 14:30646 (R;US)
Metal wastage in fluidized-bed combustors, 14:30281 (R;US)
MHD flow in insulating circular ducts for fusion blankets, 14:32898 (R;US)
Neutron-gamma hodoscope detection of fissile materials, 14:30631 (R;US)
New fast tuning system for the Atlas Accelerator, 14:31732 (R;US)
NNWSI [Nevada Nuclear Waste Storage Investigation] waste form testing at Argonne National Laboratory: Semiannual report, July–December 1987, 14:30611 (R;US)
Nuclear magnetic resonance imaging for quality control in the production of advanced ceramic components, 14:31863 (R;US)
Numerical computation of bifurcation phenomena and pattern formation in combustion, 14:31273 (R;US)
Numerical simulation of natural circulation phenomena in a PWR during TMLB' transients prior to core damage, 14:30877 (R;US)
Source-level transformations for multiple specialization of horn clauses, 14:32984 (R;US)
Study of nanophase TiO_2 grain boundaries by Raman spectroscopy, 14:31271 (R;US)
Subexcitation electrons in gas phase, 14:32489 (R;US)
The Argonne low level ^{14}C counting system, 14:31905 (R;US)
The Aspun Project, 14:31694 (R;US)
The development of a laser-driven spin-polarized dieuterium target, 14:31733 (R;US)
The potential of continuous emission monitoring of hazardous waste incinerators using Fourier transform infrared spectroscopy, 14:31919 (R;US)
The role of regional activity forecasts in projecting emission trends of acid deposition precursors, 14:31918 (R;US)
The Soudan 2 proton decay experiment, 14:31801 (R;US)
Vacuum system development status for the APS [Advanced Photon Source] storage ring, 14:31785 (R;US)
"Normal" tissues from humans exposed to radium contain an alteration in the c-mos locus, 14:32371 (R;US)

Argonne National Lab., IL (USA). Energy and Environmental Systems Div.
User guide for the Data Analysis, Retrieval, and Tabulation System (DARTS): A mainframe computer code for generating cross-tabulation reports, 14:30970 (R;US)

Argonne National Lab., IL (USA). High Energy Physics Div.
Fermionic center in the superconformal algebra on the supertorus, 14:32819 (R;US)

Argonne National Lab., Washington, DC (USA)
Illustrative emission reduction scenarios, 14:31922 (R;US)

Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)
Potential therapeutic applications for interleukin 1: anti-tumor and hematopoietic effects, 14:32364 (R;US)

ASEA-ATOM AB, Vaesteraas (Sweden)
Arrangement for cooling a nuclear power plant, 14:30870 (TG;US)

Associacao Brasileira de Ceramica, Sao Paulo, SP (Brazil)
Dielectric and piezoelectric properties of PZT sintered in low temperatures, 14:31280 (R;BR;In Portuguese)
Electron paramagnetic resonance in the orthorhombic and tetragonal phases of YBa/sub 2/Cu/sub 3/O/sub x/, 14:32795 (R;BR;In Portuguese)
SAXS study of silica sols, gels and glasses obtained by the sol gel process, 14:32748 (R;BR;In Portuguese)
X-ray diffraction identification of clay minerals by microcomputer, 14:32430 (R;BR;In Portuguese)

Associacao Brasileira de Ciencias Mecanicas, Rio de Janeiro, RJ (Brazil)
Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus, 14:30851 (R;BR;In Portuguese)
Transport coefficients for laminar and turbulent flow through a four-cusp channel, 14:31655 (R;BR)

Associacao Brasileira de Metais, Sao Paulo, SP (Brazil)
Advantage of uranium contained in low grade dolomite ore, 14:30427 (R;BR;In Portuguese)
Obtainment of sodium vanadate in sulfuric medium, 14:31386 (R;BR;In Portuguese)

Associacao Latino-Americana de Metalurgia e Materiais, Rio de Janeiro, RJ (Brazil)
Acid lixiviation of phophorite minerals for uranium extraction, 14:30429 (R;BR;In Spanish)
Comparative study of chemical cold agglomeration between two Brazilian phosphate fines: Patos de Minas and Catalao-Go, Brazil, 14:31389 (R;BR;In Portuguese)
Factors affecting stress distribution and displacements in crystals III-V grown by Czochralski method with liquid encapsulation, 14:31282 (R;BR;In Spanish)
Plastic behaviour of zircoloy-4 sheets in function of the temperature, 14:31210 (R;BR;In Spanish)
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Use of overlapped reflection for determining the retained austenite by X-ray diffraction, 14:32797 (R;BR;In Spanish)

Association Euratom-CEA, Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France). Dept. de Recherches sur la Fusion Controlee
Effect of pump limiter throat on pumping efficiency, 14:32860 (R;FR)
Role of the pump limiter throat-ergodic divertor effect on edge plasma, 14:32861 (R;FR)
Study of magnetic field lines after perturbation of a toroidal field with magnetic surfaces, 14:32869 (R;FR;In French)

Australian National Univ., Canberra (Australia). Dept. of Nuclear Physics
/sup 20/Ne(/sup 16/O, /sup 16/O)/sup 20/Ne excitation function at θ/sub CM/ = 90 deg. and parity - dependent interactions, 14:32695 (R;AU)
Comment on X-ray production by Pt and Os projectiles moving in thick Fe Targets with E/sub p/ = 17.30 MeV, 14:32783 (R;AU)
Corona gradient distribution system variations and homogenization, 14:31691 (R;AU)
Coulomb excitation of the 4/sup +//sub 1/ states of /sup 194/Pt, /sup 196/Pt and /sup 198/Pt, 14:32677 (R;AU)
Deposition techniques for the preparation of thin film nuclear targets, 14:31178 (R;AU)
Electric quadrupole moments of the first excited state of /sup 192/Os, 14:32679 (R;AU)
Gridded buncher - far field extension using carbon coated teflon/sub R/ sleeves, 14:31862 (R;AU)
Identification and rejection of energy-degraded events in gas ionization counters, 14:31802 (R;AU)
Mass of /sup 37/P, 14:32662 (R;AU)
Measurement of the mass of /sup 39/Sc, 14:32488 (R;AU)
Observation of sub-barrier fusion enchancement due to negative hexadecapole deformations, 14:32674 (R;AU)
Recent developments in heavy-ion induced fission, 14:32694 (R;AU)
Spectroscopy and octupole coupling of high-spin states in /sup 213/Rn, 14:32678 (R;AU)
Studies of the T/sub Z/ = 5/2 nuclei /sup 31/Al and /sup 29/Mg, 14:32661 (R;AU)

Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)
Correcting the error in neutron moisture probe measurements caused by a water density gradient, 14:31990 (R;AU)
Dosimetry and irradiation methods for the ANSTO gamma technology research irradiator (GATRI), 14:30643 (R;AU)
Environmental survey at Lucas Heights Research Laboratories, 1985, 14:30621 (R;AU)
Labelling of TTHA coupled IgG and MCAb with rare earth radionuclides. I. research on labelling process, 14:31574 (R;AU)
Lithium compensation of GaAs, 14:31177 (R;AU)
Nuclear power and the nuclear fuel cycle. A quarterly review of overseas events, 14:30991 (R;AU)
Program of research 1988-89, 14:32971 (R;AU)
Rum Jungle tailings dam - chemical profile of the subsoil, 14:30620 (R;AU)
Tritium activity in Australian rainwater 1962-1986, 14:32050 (R;AU)

Automated Sciences Group, Inc., Oak Ridge, TN (USA)
Tumulus Disposal Demonstration Project assessment plan for potential worker exposure: Revision 1, 14:30570 (R;US)

B

B.E.S.T. Energy Systems, Inc., Oakville, ON (Canada)
Monitoring of a heat pump heat recovery system, 14:31055 (R;CA)

Bahia Univ., Salvador (Brazil). Inst. de Geociencias
Geology and Geochemistry of the Poco de Fora region-Curaca river valley-Bahia-Brazil, 14:32415 (R;BR;In Portuguese)

Battelle Columbus Div., OH (USA)
Gas-engine heat-pump system and component efficiency and reliability improvement. Phase 2 report, September 1986-January 1989, 14:31074 (R;US)
Methanol Bus Program data analysis report. Interim report, September 1987-June 1988, 14:31163 (R;US)
Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988, 14:31098 (R;US)
Training manual for methanol-fuel use in transit operations, 14:31097 (R;US)

Battelle Columbus Labs., OH (USA)
Preliminary assessment of an inflatable inspection probe: Phases 1 and 2, 14:30866 (R;US)

Battelle Memorial Inst., Columbus, OH (USA)
Development of the electroacoustic dewatering (EAD) process for fine/ultrafine coal: Second quarterly progress report period ending 31 March 1989, 14:30239 (R;US)

Bechtel Power Corp., San Francisco, CA (USA)
Freeze sealing (plugging) of piping: A guide for nuclear power plant maintenance personnel, 14:30867 (R;US)

Bhabha Atomic Research Centre, Bombay (India)
BARC annual report 1987, 14:32964 (R;IN)
Data base pertinent to earthquake design basis, 14:30878 (R;IN)
Importance biasing for 1-D deep-penetration problem by Monte Carlo, 14:32747 (R;IN)
Research and development activities of the seismology section for the period January 1986 to December 1987, 14:32418 (R;IN)
Simultaneous estimation of Pu and fission products by gamma spectrometry, 14:31383 (R;IN)
Some studies on fluid structure interaction problems, 14:31653 (R;IN)

Bielefeld Univ. (Germany, F.R.). Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS)
Euclidean quantum mechanics: Analytical approach, 14:32838 (R;DE)

Board of Accident Investigations, Stockholm (Sweden)
Standby after the Chernobyl accident, 14:30907 (R;SE;In Swedish)

Bochum Univ. (Germany, F.R.). Fakultaet fuer Maschinenbau
Optimization of the tobacco-drying process with respect to possible applications of solar radiation, 14:30754 (R;DE;In German)

Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 151 - Tragverhalten und Tragfaehigkeit von Baukonstruktionen unter Dynamischen Einwirkungen
Vibration transmission behaviour of reinforced concrete components under extreme impact stresses, 14:30922 (R;DE;In German)

Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen
Euclidean quantum mechanics: Analytical approach, 14:32838 (R;DE)

Brasilia Univ., DF (Brazil). Dept. de Fisica
InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)
Long-wavelength behaviour of charge-charge structure factor in insulating and metallic ground state of condensed hydrogen under pressure, 14:32803 (R;BR)
Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)
Optical investigation of atomic steps in ultra-thin InGaAs/InP quantum wells grown by vapor levitation epitaxy, 14:31230 (R;BR)
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)

British Columbia Hydro, Vancouver, BC (Canada)
B.C. Hydro, annual report, 1988, 14:31006 (R;CA)

British Columbia Hydro, Vancouver, BC (Canada). Recreation Land Management
Recreation opportunities inventory, 14:30678 (R;CA)

British Columbia Ministry of Environment and Parks, Victoria, BC (Canada)
An air management strategy for Williams Lake, 14:31915 (R;CA)
The provincial role in municipal solid waste management. A discussion paper, 14:31134 (R;CA)
Woodwaste incineration and air quality in Williams Lake, 14:31914 (R;CA)

British Columbia Petroleum Corp., Oakville, ON (Canada)
British Columbia Petroleum Corporation annual report, 1987-88, 14:30317 (R;CA)

Brookhaven National Lab., Upton, NY (USA)
A process for solidifying sodium nitrate waste in polyethylene, 14:30454 (R;US)
AGS experiments, 1986, 1987, 1988, 14:32542 (R;US)
Alternatives to dose, quality factor and dose equivalent for low level irradiation, 14:32367 (R;US)
Antibody-gold cluster conjugates, 14:32177 (P;US)
Biothermochemical conversion of a bituminous coal, 14:30245 (R;US)
Brookhaven Highlights, October 1, 1987–September 30, 1988, 14:30986 (R;US)
Brookhaven National Laboratory technology transfer five year plan fiscal years 1990-1994, 14:30985 (R;US)
Cost reduction in absorption chillers: Phase 2, 14:31056 (R;US)
Developments in geothermal waste treatment biotechnology, 14:30766 (R;US)
Environmental Chemistry Division: Annual report, 1988, 14:31916 (R;US)
Evaluation of non-radiological water chemistry at power reactors, 14:30824 (R;US)
Materials and degradation modes in an alternative LLW [low-level waste] disposal facility, 14:30455 (R;US)
MPS [Multiparticle Spectrometer] data acquisition software system, 14:31804 (R;US)
MWPC with highly segmented cathode pad readout, 14:31803 (R;US)
Occupational exposures and practices in nuclear power plants, 14:30895 (R;US)
Rare K decays and limits on new forces, 14:32581 (R;US)
Search for violation of time reversal invariance in $K_{\mu 3}$ decays, 14:32545 (R;US)
Technical development of HEPVM software, Paris, Lyon, France. April 17-26, 1989: Foreign trip report, 14:32996 (R;US)
The search for a heavy Higgs boson, 14:32580 (R;US)
Understanding the performance of x-ray mirrors, 14:31588 (R;US)
[Coil production facilities, Karlsruhe, Germany and Bagneux, France, May 8–10, 1989]: Foreign trip report, 14:31736 (R;US)
[Developments in data acquisition hardware and software, CERN, Geneva, Switzerland, Frankfurt W. Germany, Oxford, UK, April 4-15, 1989]: Foreign trip report, 14:31737 (R;US)
[International conference on synchrotron radiation application, with visits to Beijing, Hefei, and Shanghai, China, April 30–May 18, 1989]: Foreign trip report, 14:31712 (R;US)
[Visit to Bruker Analytische Messtechnik to expedite delivery of the AGS Booster Quadrupole Magnet Coils, Karlsruhe, W. Germany, February 16–March 4, 1989]: Foreign trip report, 14:31735 (R;US)

Brown (K.W.) and Associates, Inc., College Station, TX (USA)
Hazardous-waste land treatment, 14:31999 (R;US)

Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene
Bibliographic study on molybdenum biokinetics, 14:32396 (R;DE;In German)

Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)
Characterisation of novel matrix catalysts and catalyst selectivity control for alpha olefin synthesis on the basis of CO and H/sub 2/, 14:30264 (R;DE;In German)
Gross properties of nuclei and nuclear excitations. Proceedings, 14:32722 (R;DE)

Bureau of Occupational Safety and Health, Cincinnati, OH (USA)
Pneumoconiosis in Appalachian bituminous coal miners, 14:30284 (R;US)

C

C-E Environmental, Inc., Chapel Hill, NC (USA)
Annual report on establishment and operation of the eastern fine-particle and visibility network, 14:31958 (R;US)

Calgary Univ., AB (Canada)
International Atomic Energy Aagency safeguards: observations on lessons for verifying a chemical weapons convention, 14:31171 (R;CA)

Calgary Univ., AB (Canada). Kananaskis Centre for Environmental Research
The present and potential effects of acidic and acidifying air pollutants on Alberta's environment. Summary report, 14:31923 (R;CA)

California Univ., Berkeley, CA (USA). Dept. of Civil Engineering
Structural engineering, mechanics and materials: Final report, 14:31618 (R;US)

California Univ., Berkeley, CA (USA). Dept. of Nuclear Engineering
The effect of precipitation on contaminant dissolution and transport: Analytic solutions, 14:30567 (R;US)

California Univ., Davis, CA (USA). School of Veterinary Medicine
Laboratory for Energy-Related Health Research: Annual report, fiscal year 1987, 14:32394 (R;US)

California Univ., Los Angeles, CA (USA). Inst. of Geophysics and Planetary Physics
Computer simulations of cosmic-ray diffusion near supernova remnant shock waves, 14:32463 (R;US)

California Univ., San Diego, La Jolla, CA (USA). Inst. of Marine Resources
Primary production, nutrients, and particulate matter in the southern California bight: Contributions to the C, N, and O_2 budgets: A component of the California Basin Study (CaBS): [Progress report, November 1988], 14:32438 (R;US)

Calspan UB Research Center, Buffalo, NY (USA)
Studies of the structure of attached and separated regions of viscous/inviscid interaction and the effects of combined surface roughness and blowing in high-Reynolds-number hypersonic flows. Final report, 1 August 1985-1 June 1988, 14:31652 (R;US)

Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada)
Combustion enhancement by induced Rayleigh instability, 14:31681 (R;CA)
Derivation of the brake-specific ventilation equation and on operating load factor expression relevant to the use of diesel machinery underground, 14:31917 (R;CA)
Design operating manual for heavy oil miniplant, 14:30416 (R;CA)
Low NO/sub x//SO/sub x/ burner trials. CFB Gagetown, 14:31680 (R;CA)

Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Mineral Sciences Labs.
Fly ash in concrete. Compilation of abstracts of papers from recent international conferences and symposia on fly ash in concrete, 14:31111 (R;CA)

Canada Centre of Mineral and Energy Technology, Ottawa, ON (Canada). Metals Technology Labs.
Effects of attachment thickness and weld profile on fatigue life of welded joints, 14:31196 (R;CA)

Canada Oil and Las Lands Administration, Ottawa, ON (Canada)
Status of the federal-provincial government response to the West Coast offshore exploration environmental assessment panel report, 14:30302 (R;CA)

Canadian Council of Resource and Environment Ministers, Downsview, ON (Canada)
National inventory of PCB waste storage sites, 14:31994 (R;CA)

Canadian Electrical Association, Montreal, PQ (Canada)
Epidemiological studies relating human health to electric and magnetic fields. Criteria for evaluation, 14:32408 (R;CA)

Cargocaire Engineering Corp., Amesbury, MA (USA)
Development and field test of a desiccant-based air conditioning system for supermarkets. Final report, October 1983-May 1988, 14:31073 (R;US)

Case Western Reserve Univ., Cleveland, OH (USA). Case Center for Electrochemical Sciences
Electrochemical characteristics of acid electrolytes for fuel cells. Final report, August 1, 1985-December 31, 1988, 14:31047 (R;US)

Caterpillar, Inc., Peoria, IL (USA)
Development of fast-burn combustion with elevated coolant temperatures for natural gas engines. Annual report, May 1987-April 1988, 14:31165 (R;US)

CEA Centre d'Etudes de Bruyeres-le-Chatel, 91 (France)
How to minimize wastes, 14:31180 (R;FR;In French)
Requirements of high-surface electric fields for high-brightness FeI injectors, 14:31731 (R;FR)

CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)
Gain measurements at 5nm in nickel like ytterbium, 14:31179 (R;FR)

CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)
Alternative fuels for the French fast breeder reactors programme, 14:30848 (R;FR)

CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France)
Manufacture of the first fuel charge for the SUPER-PHENIX 1 reactor, 14:30847 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Analyse de Surete
Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif
Last improvements of the DTC 1000 spectrophotometer, 14:30437 (R;FR;In French)
Optical fibers and sensors for chemistry, 14:31589 (R;FR)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection Sanitaire
Biological assessment of occupational exposure to actinides: Programme; Book of Abstracts, 14:32368 (R;FR)

CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)
Use of various ionization modes for the study of molecules of biological interest, 14:31384 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques
Expert systems for analysis and management assistance of nuclear reactor electrical power supplies, 14:30863 (R;FR)
French studies for improvement of the data for radioactive sources, 14:30856 (R;FR)
Neutron and gamma transport in air by TRIPOLI-2 time dependent energy deposition and electron current calculation, 14:32982 (R;FR)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Biologie
Ionization technology, 14:30645 (R;FR;In French)
Radiation disinfestation of stored cereals, 14:30644 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire
Activity report, 14:32650 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie
Cascade effects in non equilibrium phase transitions with metallurgical relevance, 14:31181 (R;FR)
Electronic structure and chemical bond of high Tc superconductors, 14:31268 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)
Review of the utilization of laser and electron beam methods in the nuclear domain, 14:32784 (R;FR;In French)

Central Inst. of Physics, Bucharest (Romania). Inst. of Physics and Nuclear Engineering
Competing mechanisms in helium ions induced fission. The role of shell effects, 14:32717 (R;RO;In Romanian)

Contributions to the study of environmental radioactivity, 14:32009 (R;RO;In Romanian)
Contributions to the study of nuclei from the region Gd-146 excitation modes and interactions, 14:32721 (R;RO;In Romanian)
Highly excited nuclei state and level densities, 14:32716 (R;RO;In Romanian)
Interaction cross sections for multinucleonic processes in light nuclear systems, 14:32719 (R;RO;In Romanian)
Investigation of the reaction mechanisms in /sup 19/F -medium-light nuclei systems, 14:32718 (R;RO;In Romanian)
Modeling of the behaviour under irradiation of the nuclear fuel containing thorium, uranium and plutonium oxides, 14:30436 (R;RO;In Romanian)
Study of fission gases behaviour in the Romanian UO/sub 2/, 14:30435 (R;RO;In Romanian)
Study of nuclear potentials used in heavy ions scattering, 14:32720 (R;RO;In Romanian)
Study of spectroscopical properties of intermediate and heavy nuclei, 14:32715 (R;RO;In Romanian)

Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ (Brazil)
Geochronology and geochemistry by nuclear tracks method: some utilization examples in geologic applied, 14:32412 (R;BR;In Portuguese)

Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)
25/sup th/ birthday of the first criticality of IPR-R1 nuclear research reactor, 14:30890 (R;BR;In Portuguese)

Centro de Energia Nuclear na Agricultura, Piracicaba, SP (Brazil)
Environment and nuclear war, 14:32008 (R;BR)
Isotopes and agriculture, 14:32358 (R;BR;In Portuguese)
Nuclear energy and the environment, 14:30880 (R;BR;In Portuguese)

Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Atividades Espaciais
Activities planning of Nuclear Data Center - 1980, 14:32645 (R;BR;In Portuguese)
Calculation of nuclear parameters for some heavy isotopes, 14:30858 (R;BR;In Portuguese)
Comments on MC/sup 2/-2 and MINX computer codes, 14:32990 (R;BR;In Portuguese)
Program of evaluations for nuclear data centers, 14:30859 (R;BR;In Portuguese)

Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados
Adaptation of HAMMER computer code to CYBER 170/750 computer, 14:32991 (R;BR;In Portuguese)
Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections, 14:32995 (R;BR;In Portuguese)
Generation and tests of the new version 88 library for HAMMER system, 14:32994 (R;BR;In Portuguese)
Generation of one energy group cross section library with MC/sup 2/ computer code, 14:30860 (R;BR;In Portuguese)
Implantation of multigroup diffusion code 2DB in the IEAv CDC CYBER 170/750 system, and its preliminary evaluation, 14:30861 (R;BR;In Portuguese)
Pseudo-harmonics method: an application involving perturbations caused by control rod insertion in PWR reactors, 14:30874 (R;BR)
Review of unresolved resonance treatments in multigroup processing computer codes, 14:30862 (R;BR;In Portuguese)
Transient performance of flow in circuits of PWR type reactors, 14:30837 (R;BR;In Portuguese)
Uranium alloys for using in fast breeder reactors, 14:31189 (R;BR;In Portuguese)
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)
Use of ETOG computer code for preparing the epithermal library of HAMMER with data from ENDF/B-IV, 14:32992 (R;BR;In Portuguese)

CH2M Hill, Gainesville, FL (USA)
Installation restoration program. Phase 2. Confirmation/quantification stage 2, Moody Air Force Base, Georgia. Appendices. Volume 2. Final report, October 1986-November 1987, 14:32031 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)

Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics
Calculation of triton confinement and burn-up in tokamaks, 14:32902 (R;SE)

Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. of Theoretical Physics
Tunneling through a time-modulated barrier - relation to tunneling times, 14:32833 (R;DK)

Chalmers Univ. of Tech., Goeteborg (Sweden). Onsala Space Observatory
Mass distribution in the galactic centre estimated from OH/IR stars, 14:32460 (R;SE)

Chicago Univ., IL (USA). Dept. of Chemistry
Wetted solid - a generalization of Plateau's problem and its implications for sintered materials, 14:31325 (R;DK)

Chicago Univ., IL (USA). James Franck Inst.
Wetted solid - a generalization of Plateau's problem and its implications for sintered materials, 14:31325 (R;DK)

China Nuclear Information Centre, Beijing, BJ (China)
Flux weighted method for solution of stiff neutron dynamic equations and its application, 14:30896 (R;CN;In Chinese)
On-line monitor for cation exchange elution chromatography using lithium silicate glass beads as solid scintillator, 14:31806 (R;CN;In Chinese)
Research on the adsorption of technetium and iodine in some minerals, 14:32006 (R;CN;In Chinese)
Solving the non-isothermal kinetic curves of gas-solid reactions by non-linear fitting method, 14:31465 (R;CN;In Chinese)
Study of computational method about equations for laser fusion with superthermal electron transport and its applications, 14:32897 (R;CN;In Chinese)
Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent extraction-liquid scintillation count method, 14:31805 (R;CN;In Chinese)

City Coll., New York, NY (USA). Dept. of Physics
Thermodynamics and high temperature chemistry of the chemical vapor deposition of diamond films, 14:31318 (R;US)

Coal Mining Research Centre, Edmonton, AB (Canada)
Procedural guide for roof bolt anchorage tests, 14:31685 (R;CA)
Thick seam mining methods review of CMRC literature search, 14:30279 (R;CA)

Cold Spring Harbor Lab. of Quantitative Biology, ME (USA)
Eukaryotic transposable elements as mutagenic agents, 14:32077 (R;US)

Cold Spring Harbor Lab., NY (USA)
Cold Spring Harbor symposia on quantitative biology: Volume 51, Molecular biology of Homo sapiens, 14:32203 (B;US)

Colorado School of Mines, Golden, CO (USA)
An experimental study to determine the relative influence of fluid-fluid interactions and media heterogeneities on the growth of immiscible viscous fingers, 14:30289 (R;US)

Colorado Univ., Boulder, CO (USA). Dept. of Astrophysical, Planetary, and Atmospheric Sciences
Application of modern mathematical concepts to plasma confinement: Progress report, 14:32865 (R;US)

Columbia Univ., New York, NY (USA)
Theoretical high energy physics: Progress report, May 1, 1988–April 30, 1989, 14:32582 (R;US)

Combustion Engineering, Inc., Windsor, CT (USA). Nuclear Power Businesses
Examination of pits in Trojan nuclear power plant steam generator tubes: Final report, 14:30840 (R;US)

Comision Chilena de Energia Nuclear, Santiago (Chile)
Environmental radioactivity in Chile - during 1987 - Technical information, 14:32756 (R;CL;In Spanish)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil)
Transport, acceptance, storage and handling of the itens of nuclear power plants, 14:32757 (R;BR;In Portuguese)

Commission de la Sante et de la Securite du Travail, Montreal, PQ (Canada)
Air quality and ventilation in three office buildings, 14:31058 (R;CA;In French)

Commission of the European Communities, Brussels (Belgium). Directorate General for Science, Research and Development
Biological assessment of occupational exposure to actinides: Programme; Book of Abstracts, 14:32368 (R;FR)

Commission of the European Communities, Ispra (Italy). Joint Research Centre
Radiocesium in wheat of the Po plain, 14:31983 (R;FR;In Italian)

Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements
Bulk moduli and high pressure phases of the uranium rocksalt structure compounds. Pt. 2. The monopnictides, 14:31327 (R;DK)
Bulk moduli and high pressure phases of ThX compounds. Pt. 2. The thorium monochalcogenides, 14:31329 (R;DK)
Bulk moduli and high-pressure phases of the uranium rocksalt structure compounds. Pt. 1. The monochalcogenides, 14:31326 (R;DK)
Bulk moduli and high-pressure phases of ThX compounds. Pt. 1. The thorium monopnictides, 14:31328 (R;DK)

Commission of the European Communities, Luxembourg (Luxembourg)
Characterization of radioactive waste forms. Progress report for 1986 Volume 1, 14:30553 (R;FR)
Characterization of radioactive waste forms. Progress report for 1986 Volume 2, 14:30554 (R;FR)
Final report on a study of coherence in acceptability criteria for the technical aspects of risks associated with potentially hazardous installations, 14:30903 (R;FR)
Long-term solute diffusion in a granite block immersed in sea water, 14:30561 (R;FR)
Optimization of waste management by actions taken at source, 14:30560 (R;FR)
Scale effect experiment in a fractured rock mass phase 2. Volume 1. Description of hydraulic tests carried out on the experimental site at Fanay-Augeres, 14:30555 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 2. Interpretation and modelling of the hydraulic tests carried out on the experimental site at Fanay-Augeres, 14:30556 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 3. Description of the tracer tests carried out on the experimental site at Fanay-Augeres, 14:30557 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 5. Methodology and results of in-situ stress measurement carried out in the granitic rock mass at Fanay-Augeres, 14:30559 (R;FR;In French)
Scale effects experiment in a fractured rock mass phase 2. Volume 4. Interpretation and modelling of the tracer tests carried out on the experimental site at Fanay-Augeres, 14:30558 (R;FR;In French)
Study on sealing of boreholes, 14:30552 (R;FR;In Italian)

Companhia Baiana de Pesquisa Mineral, Salvador, BA (Brazil)
Potential of heavy minerals in the Valenca-Itacare, Bahia (Brazil) region - Sampling characterization and ore processing, 14:31388 (R;BR;In Portuguese)

CONEG Policy Research Center, Inc., Washington, DC (USA)
Northeast Regional Biomass Energy Program: Progress report, January 1989–March 1989, 14:30672 (R;US)

Conoco, Inc., Library, PA (USA). Coal Research Div.
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1, 1986–March 31, 1986, 14:30252 (R;US)
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986, 14:30253 (R;US)
Improvement in coal liquefaction solvent quality by dewaxing, 14:30246 (R;US)

Consolidation Coal Co., Library, PA (USA). Research and Development Dept.
Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986, 14:30254 (R;US)
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987, 14:30255 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987, 14:30256 (R;US)
Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987, 14:30257 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988, 14:30258 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, April 1–June 30, 1988, 14:30259 (R;US)

Copenhagen Univ. (Denmark). H.C. Oersted Inst.
Bulk moduli and high pressure phases of the uranium rocksalt structure compounds. Pt. 2. The monopnictides, 14:31327 (R;DK)
Bulk moduli and high pressure phases of ThX compounds. Pt. 2. The thorium monochalcogenides, 14:31329 (R;DK)
Bulk moduli and high-pressure phases of the uranium rocksalt structure compounds. Pt. 1. The monochalcogenides, 14:31326 (R;DK)
Bulk moduli and high-pressure phases of ThX compounds. Pt. 1. The thorium monopnictides, 14:31328 (R;DK)
Chaotic noise in superconducting microbridge 4-photon X-band parametric amplifier, 14:32816 (R;DK)
Characterization of modulated integrate-and-fire systems, 14:32830 (R;DK)
Local hysteresis in relaxation oscillators, 14:32831 (R;DK)
Mode locking in overdamped charge-density-wave systems, 14:31324 (R;DK)
Non-chaotic transition from quasiperiodicity to complete phase-locking, 14:32829 (R;DK)
Observation of the i = 1/2 fractional quantum Hall plateau in AlGaAs/GaAs/AlGaAs selectively doped double heterostructures, 14:31330 (R;DK)
Quantum Hall effect and the electrostatic Aharonov-Bohm effect, 14:32832 (R;DK)
Role of localization within the vortex picture of the fractional quantum Hall effect, 14:32828 (R;DK)
Tunneling through a time-modulated barrier - relation to tunneling times, 14:32833 (R;DK)
Wetted solid - a generalization of Plateau's problem and its implications for sintered materials, 14:31325 (R;DK)

Cornell Univ., Ithaca, NY (USA). Dept. of Chemistry
Synthesis and properties of novel cluster phases: Progress report ending June 30, 1989, 14:31471 (R;US)

Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering
Experimental studies of the structure of grain boundaries: Progress report, 14:31191 (R;US)

Cornell Univ., Ithaca, NY (USA). Mathematical Sciences Inst.
Parallel QR factorization algorithm using local pivoting, 14:32978 (R;US)

Council for Scientific and Industrial Research, Pretoria (South Africa). National Accelerator Centre
Neutron beam facility at NAC, 14:32972 (R;ZA)

Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Transport and Road Research
Combi-taxi: past, present, and future, 14:31105 (R;ZA)
Energetic approach towards affordable transportation, 14:31104 (R;US)

Cowiconsult Raadgivende Ingenioerer A/S, Virum (Denmark)
Pumped storage power plants in Denmark, 14:30795 (R;DK;In Danish)

D

D.B. Associates, Inc., Salt Lake City, UT (USA)
Hydrazine: usage and exposure in the electric power industry, 14:30808 (R;US)

Danish Aeroform APS, Viborg (Denmark)
Flap-by-flap testing for materials fatigue in Aerostar 7.5 m wind-turbine blades, 14:30788 (R;DK;In Danish)

Danish Wind Technology A/S, Viborg (Denmark)
Project for the development of competitive wind powered plants, 14:30787 (R;DK;In Danish)

Danmarks Tekniske Hoejskole, Lyngby. Afdelingen for Fluid Mekanik
Project K 30 meter glass fiber wind turbine-blade. Technological description, 14:30786 (R;DK;In Danish)

Danmarks Tekniske Hoejskole, Lyngby. Fysisk Lab. 3
Deterministic chaos in energy-technichological systems, 14:31142 (R;DK;In Danish)

Danmarks Tekniske Hojskole, Lyngby (Denmark). Lab. for Energiteknik
Internal combustion engines. Effect, and diagrammatic calculations, 14:31158 (R;DK;In Danish)
Procedures for reservoir fluid characterization using an equation of state model. Application to fluids in the Danish North Sea, 14:30393 (R;DK)
Pumped storage power plants in Denmark, 14:30795 (R;DK;In Danish)

Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering
The structure and properties of grain boundaries in B2 ordered alloys: Progress report, 14:31193 (R;US)

Dearborn Environmental Consulting Group, Mississauga, ON (Canada)
Utilization potential of circulating fluidized bed combustion residue in construction applications. Final report, 14:30272 (R;CA)

Defense Advanced Research Projects Agency, Arlington, VA (USA)
Seismic coupling of nuclear explosions: Volume 1, 14:31904 (R;US)

Denver Univ., CO (USA). Dept. of Engineering
Characterization and fundamental studies on CuO sorbent materials to determine attrition mechanisms on substrate gamma alumina: Technical progress report No. 9, September 23, 1988–December 23, 1988, 14:30804 (R;US)

Department of Energy, Mines and Resources, Ottawa, ON (Canada)
Holocene proxy-climate data from the Canadian Arctic, 14:32413 (R;CA)
Petroleum Incentives Administration annual report, 1986, 14:31004 (R;CA)
Proceedings of the 6th Canadian bioenergy research and development seminar, 14:31040 (R;CA)

Department of Energy, Mines and Resources, Ottawa, ON (Canada). Transportation Energy Div.
Proceedings of the fourth Windsor workshop on alternative fuels, 14:31154 (R;CA)

Department of Fisheries and Oceans, Winnipeg, MB (Canada). Central and Arctic Region
Phytoplankton primary production and related limnological data for lakes and channels in the Mackenzie Delta and lakes on the Tuktoyaktuk Peninsula, N.W.T., 14:32028 (R;CA)
Salinity, temperature and density data for the Canadian Beaufort Sea shelf, March 1988, 14:32439 (R;CA)

Department of the Environment, London (UK)
Evaluation of a prototype air transport system for use in a crate handling and size reduction facility, 14:30449 (R;GB)
Geochemistry and mobility of the lanthanides in marine sediments, 14:32051 (R;GB)
Inorganic anion exchangers for the treatment of radioactive wastes, 14:30532 (R;GB)
Organic resin anion exchangers for the treatment of radioactive wastes, 14:30533 (R;GB)
Use of non-dimensional representation of the solute transport equations, 14:30534 (R;GB)

Department of the Secretary of State of Canada, Montreal, PQ (Canada). Terminology and Linguistic Services Branch
Effects of acidic precipitation and related pollutants in the terrestrial environment. A program description, 14:31997 (R;CA)
Vocabulary of acid precipitation and air pollution. Terminology bulletin 175, 14:31970 (R;CA;In English and French)

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V. (DFVLR), Stuttgart (Germany, F.R.). Inst. fuer Technische Thermodynamik
Performance of highly concentrating mirror collectors and collector systems, 14:30756 (R;DE;In German)

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)
Performance of highly concentrating mirror collectors and collector systems, 14:30756 (R;DE;In German)

Deutsche Forschungsgemeinschaft, Bonn (Germany, F.R.)
Ecological effects of coal use. Final report, 14:30806 (R;DE;In German)

Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.). Hamburger Synchrotronstrahlungslabor
Photoemission from excited states in rare gas solids by combining synchrotronradiation with a laser, 14:31321 (R;DE;In German)

DK-Teknik, Soeborg (Denmark)
Measuring ammonia content in flue gas, 14:30807 (R;DK;In Danish)

Dobrocky Seatech Ltd., Sidney, BC (Canada)
Beaufort Sea artificial island erosion data, 14:30303 (R;CA)

Dravo Lime Co., Pittsburgh, PA (USA)
1.0 Million Btu combustor testing: Test results: Part 2, 14:30803 (R;US)

Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.
A mathematical model of fluid flow in the vicinity of a horizontal air-injection well, 14:32033 (R;US)
Cation resins for Cs and Sr removal in the F/H Effluent Treatment Facility, 14:30537 (R;US)
Evaluation of stream biological communities in nonthermal reaches of Four Mile Creek: Revision 1, 14:32052 (R;US)
F/H Effluent Treatment Facility ECWPF pilot test, 14:30538 (R;US)
High temperature mechanical properties and microscopic examination of extruded powder aluminum, 14:31194 (R;US)
Residence time distributions for ETF pH adjustment system, 14:30539 (R;US)

Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant
Design and testing of a heated thermocouple liquid level probe, 14:30875 (R;US)
Determination of neptunium by controlled-potential coulometry, 14:30441 (R;US)
Nuclear facility air lock design criteria, 14:30536 (R;US)
State of stress and the relation to tectonics in the central Savannah River area of South Carolina, 14:32429 (R;US)

Duke Power Co., Charlotte, NC (USA)
Seismic margin assessment of the Catawba Nuclear Station: Volume 2, Appendixes: Final report, 14:30902 (R;US)

E

EG and G Energy Measurements, Inc., Las Vegas, NV (USA)
A review of aerial radiological surveys of Nevada Test Site fallout fields 1951 through 1970, 14:31984 (R;US)

EG and G Idaho, Inc., Idaho Falls, ID (USA)
Applying understanding of individual behavior and team dynamics within the value engineering process, 14:32968 (R;US)
Evaluation of elastic-plastic surface flaw behavior and related parameters using surface displacement measurements, 14:31195 (R;US)
Fiber optic sensing for NDE and process control, 14:31110 (R;US)
PREPP [Process Experimental Pilot Plant] rotary kiln plant performance overview, 14:30540 (R;US)

EG and G Mound Applied Technologies, Miamisburg, OH (USA)
A critique of trennschaukel operation, 14:31864 (R;US)

Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik
Bulk moduli and high pressure phases of the uranium rocksalt structure compounds. Pt. 2. The monopnictides, 14:31327 (R;DK)
Bulk moduli and high pressure phases of ThX compounds. Pt. 2. The thorium monochalcogenides, 14:31329 (R;DK)
Bulk moduli and high-pressure phases of the uranium rocksalt structure compounds. Pt. 1. The monochalcogenides, 14:31326 (R;DK)
Bulk moduli and high-pressure phases of ThX compounds. Pt. 1. The thorium monopnictides, 14:31328 (R;DK)

Eimco Mining Machinery International, Salt Lake City, UT (USA)
Safety evaluation of a prototype hydride-powered underground-mining vehicle. Final report, May 1984-May 1987, 14:32410 (R;US)

Electric Power Research Inst., Palo Alto, CA (USA)
Assessment of higher-temperature superconductors for utility applications: Final report, 14:30811 (R;US)
Chemical data for predictinng the fate of organic compounds in water: Volume 1, Technical basis: Final report, 14:32035 (R;US)
Demand-side management strategies for the 90s: Proceedings: Fourth national conference on utility DSM programs: Volume 1, 14:31007 (R;US)
Evaluation of potential benefits of transportable storage casks: Final report, 14:30822 (R;US)
Examination of pits in Trojan nuclear power plant steam generator tubes: Final report, 14:30840 (R;US)
Expert training systems to enhance plant operations decision making: Final report, 14:30876 (R;US)
Freeze sealing (plugging) of piping: A guide for nuclear power plant maintenance personnel, 14:30867 (R;US)
Identification of ions near HVDC [high-voltage direct-current] transmission lines: Final report, 14:32403 (R;US)
Liner-waste compatibility studies for coal-fired power plants, 14:31112 (R;US)
Microbial corrosion: 1988 workshop proceedings, 14:30865 (R;US)
MULTEQ: Equilibrium of an electrolytic solution with vapor-liquid partitioning and precipitation: Volume 1: User's manual, Revision 1, 14:30838 (R;US)
Power plant performance monitoring and improvement: Volume 6, Economic dispatch optimization, 14:30794 (R;US)
Preliminary assessment of an inflatable inspection probe: Phases 1 and 2, 14:30866 (R;US)
Proceedings: 1986 workshop on advanced high-strength materials, 14:30821 (R;US)
PWR steam generator tube fretting and fatigue wear: Final report, 14:30839 (R;US)
Seismic margin assessment of the Catawba Nuclear Station: Volume 2, Appendixes: Final report, 14:30902 (R;US)

Electrofuel Mfg. Co., Toronto, ON (Canada)
Development of tough ceramics. Final report, 14:31320 (R;CA)

ENEA, Rome (Italy)
2-D fluid dynamics models for laser driven fusion on IBM 3090 vector multiprocessors, 14:32907 (R;IT)
Contributions to the 12th. International Cryogenic Engineering Conference. Southampton, 12-15 July 1988, 14:32905 (R;IT)
Review of the nuclear safety activities in Italy, 14:30901 (R;IT;In Italian)

Energilaboratoriet, Odense (Denmark)
Fuel cells for use in the field of transportation. American initiatives, 14:31044 (R;DK;In Danish)
Nickel - iron battery, 14:31670 (R;DK;In Danish)

Energiministeriet, Copenhagen (Denmark)
Energy planning 1988. Status report, 14:30999 (R;DK;In Danish)
Statement on energy policy 1988. Statement by the Ministry of Energy on laws concerning energy policy measures and Danish Oil and Natural Gas A/S, 14:31000 (R;DK;In Danish)

Energy Options, Ottawa, ON (Canada)
Energy and Canadians into the 21st century. A report of the energy options process, 14:30972 (R;CA;In English and French)

Energy Resources Conservation Board, Calgary, AB (Canada)
Alberta gas reserve trends, 14:30315 (R;CA)
Gas supply and transportation services inquiry, 14:30318 (R;CA)

Energy Resources of Australia, Sydney (Australia)
Application of best practicable technology to water management at Ranger Uranium mine: report of the technical working group, 14:30623 (R;AU)

Energy Systems Research Group, Inc., Boston, MA (USA)
Resource recovery facility siting: Recommendations for economic and other equity adjustments: Final report, 14:31039 (R;US)

Engineering Interface Ltd., Willowdale, ON (Canada)
Lighting energy conservation from labelling switches - a study. Final report, 14:31065 (R;CA)

Entropy Environmentalists, Inc., Research Triangle Park, NC (USA)
Evaluation of HCl continuous-emission monitors. Final report, May 1986-May 1987, 14:31949 (R;US)

Enviresponse, Inc., Livingston, NJ (USA)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)

Environment Canada, Ottawa, ON (Canada)
The changing atmosphere. Implications for global security. Conference statement, 14:30978 (R;CA;In English and French)

Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate
Development of an oil spill simulation model for the Saint-Lawrence River, 14:30304 (R;CA;In French)
Studies of the ionic balance of Laflamme Lake in 1985 and 1986, 14:32034 (R;CA;In French)

Environmental Protection Agency, Ann Arbor, MI (USA)
Evaluation of a resistively heated metal-monolith catalytic converter on a gasoline-fueled vehicle. Technical report, 14:31160 (R;US)

ERA Technology Ltd., Leatherhead (UK)
Building and energy-management systems: a user guide, 14:31067 (R;US)

European Space Agency, 75 - Paris (France)
Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium, 14:32445 (R;FR)
Decade of UV astronomy with the IUE satellite. Volume 1. Proceedings of a celebratory symposium, 14:32446 (R;FR)

Exxon Research and Engineering Co., Annandale, NJ (USA)
Wetted solid - a generalization of Plateau's problem and its implications for sintered materials, 14:31325 (R;DK)

F

Federal Communications Commission, Washington, DC (USA). Office of Engineering and Technology
Questions and answers about biological effects and potential hazards of radiofrequency radiation (third edition), 14:32406 (R;US)

Fenix and Scisson, Inc., Tulsa, OK (USA)
NNWSI [Nevada Nuclear Waste Storage Investigations] 51 seismic hole histories, 14:30527 (R;US)

Fermi National Accelerator Lab., Batavia, IL (USA)
Coherent betatron instability driven by electrostatic separators: Stability analysis of the Tevatron, 14:31713 (R;US)
Hermeticity of three cryogenic calorimeter geometries, 14:31811 (R;US)
Orbital dynamics in the Tevatron double helix, 14:31714 (R;US)
Understanding and improving the high field orbit in the Fermilab Booster, 14:31715 (R;US)
$\bar{p}p$ collider physics, 14:32544 (R;US)

Fish and Wildlife Service, Washington, DC (USA). Div. of Endangered Species and Habitat Conservation
Endangered Species Listing Handbook: handbook to preparing and processing actions to list, delist, or reclassify endangered or threatened species (third edition), 14:32076 (R;US)

Florida Agricultural and Mechanical Univ., Tallahassee, FL (USA). Dept. of Physics
Analytical evaluation of multicenter molecular integrals over Slater-type orbitals using expanded Loewdin alpha functions, 14:32483 (R;US)

Inclusion of electron correlation for the target wave function in low- to intermediate-energy e-N_2 scattering, 14:32482 (R;US)

Florida State Univ., Tallahassee, FL (USA). Inst. of Molecular Biophysics

Energy transformation in molecular electronic systems: Comprehensive progress report, 1986–1989, 14:31472 (R;US)

Florida Univ., Gainesville, FL (USA). Inst. of Food and Agricultural Sciences

Sorption of selected volatile organic constituents of jet fuels and solvents on natural sorbents from gas and solutions phases. Final report, April 1985-September 1987, 14:30298 (R;US)

Foersvarets Forskningsanstalt, Stockholm (Sweden)

Resuspension of radionuclides during cultivation. Results from a single sample analysis, Spring 1987, 14:32007 (R;SE;In Swedish)

Franklin Inst. Research Labs., Philadelphia, PA (USA)

Studies of synthesis, crystallography and sintering of β-aluminas: Final report, April 15, 1976–April 15, 1977, 14:31279 (R;US)

Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Karlsruhe (Germany, F.R.). Inst. fuer Systemtechnik und Innovationsforschung

Ecological effects of coal use. Final report, 14:30806 (R;DE;In German)

Freeze Technology International, Inc., Houston, TX (USA)

Freeze sealing (plugging) of piping: A guide for nuclear power plant maintenance personnel, 14:30867 (R;US)

Freie Univ. Berlin (Germany, F.R.)

Prospective study on the behaviour of values obtained by organ function studies, in particular scintiscan studies of pulmonary perfusion, during treatment of little to moderately advanced tuberculosis, shown by X-rays to involve one lobe of the lung, 14:32347 (R;DE;In German)

G

General Atomics, San Diego, CA (USA)

60 MHz fast wave current drive experiments for DIII-D, 14:32871 (R;US)

High power ion Bernstein wave experiments on DIII-D, 14:32870 (R;US)

General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation

A statistical analysis of measured river contamination at selected shoreline locations, 14:32053 (R;US)

Iodine emission from separations processes and flowsheets for improved emission control, 14:30562 (R;US)

General Physics Corp., Columbia, MD (USA)

Expert training systems to enhance plant operations decision making: Final report, 14:30876 (R;US)

Generay Research Corp., McLean, VA (USA)

Expert-system approach to large space-systems control. Technical report, September 1987-October 1988, 14:31891 (R;US)

Geological Survey, Denver, CO (USA)

US Geological Survey publications on western tight gas reservoirs, 14:30314 (R;US)

Georgia Inst. of Tech., Atlanta, GA (USA)

Metastable enhancement of C^+ and O^+ capture reactions: Annual report, July 1, 1988–June 30,1989, 14:32491 (R;US)

PVREG – a photovoltaic voltage regulation investigation tool: PVREG user's manual, 14:30747 (R;US)

Georgia Inst. of Tech., Atlanta, GA (USA). Electromagnetics Lab.

Identification of ions near HVDC [high-voltage direct-current] transmission lines: Final report, 14:32403 (R;US)

Georgia State Univ., Atlanta, GA (USA). Dept. of Physics

Photoabsorption and photoionization cross sections: an overview of the current state of knowledge, 14:32484 (R;US)

Photoionization cross sections of positive ions, 14:32485 (R;US)

Photoionization of Al^+ ions: a relativistic random phase approximation study, 14:32486 (R;US)

Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)

List of reports in the field of reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC. Reported period: 1 October - 31 December 1988, 14:30904 (R;DE;In German)

Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)

Correlations between dilepton yields and pion multiplicities as probe of the deconfinement transition, 14:32704 (R;DE)

Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)

Filamentation of phase space and coherent noise for beams injected into storage rings, 14:31740 (R;DE)

Fine focusing of intense heavy ions for the production of hot dense matter, 14:31739 (R;DE;In German)

Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)

Giant dipole resonances in hot nuclear matter in the model of self-relaxing mean-field, 14:32707 (R;DE)

Gross properties of nuclei and nuclear excitations. Proceedings, 14:32722 (R;DE)

Monopole and quadrupole vibrations of a hot nucleus, 14:32705 (R;DE)

Status of the SIS/ESR-project at GSI, 14:31695 (R;DE)

Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)

Investigation of the induction of oxidative DNA damage by means of an enzyme-linked immunosorbent assay (ELISA) for thymine glycol containing DNA, 14:32208 (R;DE;In German)

Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Toxikologie

Investigation of the induction of oxidative DNA damage by means of an enzyme-linked immunosorbent assay (ELISA) for thymine glycol containing DNA, 14:32208 (R;DE;In German)

Giessen Univ. (Germany, F.R.)

Fine focusing of intense heavy ions for the production of hot dense matter, 14:31739 (R;DE;In German)

Giner, Inc., Waltham, MA (USA)

Development of ternary alloy cathode catalysts for phosphoric acid fuel cells: Final report, 14:31043 (R;US)

Goettingen Univ. (Germany, F.R.). Fachbereich Physik

Density-depending time-differential perturbed angular correlation in gas-phase /sup 111/InCl, 14:32665 (R;DE;In German)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR)

Methods and programs for numerical solution of the mathematical physics problems. Scientific-technical collection, 14:32824 (R;SU;In Russian)

Neutron physics. Vol. 2, 14:32647 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Teoreticheskoj i Ehksperimental'noj Fiziki

Computer experiment for 3.65 GeV proton beam with a lead target for comparison of the MARS4 and HETC computer codes, 14:30842 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike

Physics of radiation defects and radiation material science. Scientific-technical collection, 14:31173 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.

Development of charging belt for electrostatic accelerators, 14:31738 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij

Control system of magnetic optical element power supplies for some beam channels, 14:31741 (R;SU;In Russian)

Electromagnetic radiation shaping in a plane ondulator with groved pole surface, 14:31716 (R;SU;In Russian)

PIPE-LINE feature implementation on RSx11M operating system, 14:32997 (R;SU;In Russian)

Spectral and angular distributions of charged particles outside biological shielding of the 70 GeV Serpukhov accelerator, 14:31742 (R;SU;In Russian)

Status and development of Serpukhov tevatron, 14:31787 (R;SU;In Russian)

Gregg River Resources Ltd., Hinton, AB (Canada)
Demonstration and evaluation of an integrated truck management system in a producing Canadian surface coal or oil sands mine, 14:30336 (R;CA)

Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules
Capacitive device approach to gravitational wave detection, 14:32834 (R;FR)

H

Hamburg Univ. (Germany, F.R.). Fachbereich Physik
Photoemission from excited states in rare gas solids by combining synchrotronradiation with a laser, 14:31321 (R;DE;In German)

Hanford Engineering Development Lab., Richland, WA (USA)
Effects of fast neutron irradiation on thermal conductivity of Li_2O and $LiAlO_2$, 14:32915 (R;US)
Mixed oxide fuel development, 14:30850 (R;US)

Hanford Environmental Health Foundation, Richland, WA (USA)
United States transuranium registry: Annual report, 1 October 1987–30 September 1988, 14:32372 (R;US)

Hart (Fred C.) Associates, Inc., New York, NY (USA)
Installation-Restoration Program. Phase 2. Confirmation/quantification stage 1 for Minot Air Force Base, Minot, North Dakota. Volume 2. Appendices A through F. Final report, September 1985-October 1988, 14:32032 (R;US)

Harvard Univ., Cambridge, MA (USA)
[Fundamental studies of carbenes and hydrocarbon radicals]: Progress report, 14:31468 (R;US)

Hoffman-Holt, Inc., Silver Spring, MD (USA)
Technical/economic impacts and implications of using washed coals at New York State utilities. Final report, 14:30798 (R;US)

Hughes Research Labs., Malibu, CA (USA)
High-brightness diode lasers for blue-green applications. Interim technical report, 1 July 1987-31 December 1988, 14:31627 (R;US)

I

ICF, Inc., Fairfax, VA (USA)
Toxic chemical release inventory magnetic media submission instructions. Section 313 of the emergency planning and community right-to-know act (revision), 14:30980 (R;US)

Idaho Dept. of Fish and Game, Boise, ID (USA). Fisheries Research Section
Kokanee stock status and contribution Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho: Annual progress report FY 1988, 14:30679 (R;US)

IEA Consulting Group Ltd., Charlottetown, PE (Canada)
Comparative evaluation of hot water and steam distribution systems for district heating. Final report, 14:31138 (R;CA)
Comparative evaluation of hot water and steam distribution systems for district heating. Summary, 14:31139 (R;CA)

IIT Research Inst., Chicago, IL (USA)
Radio-frequency enhanced decontamination of soils contaminated with halogenated hydrocarbons, 14:31998 (R;US)

Illinois Inst. of Tech., Chicago, IL (USA)
Theoretical studies in elementary particle physics: Progress report, March 1988–January 1989, 14:32584 (R;US)

Illinois Inst. of Tech., Chicago, IL (USA). Fluid Dynamics Research Center
Feasibility and analysis of fluidic-type devices in gas flow measurements. Final report, March 1987-March 1988, 14:30320 (R;US)

Illinois Univ., Urbana, IL (USA)
Forces through epitaxially grown interfaces, 14:31184 (R;US)

Illinois Univ., Urbana, IL (USA). Coll. of Engineering
Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985, 14:30799 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Nuclear Engineering
The study of neutralization of Po-218 ions by small ion recombination in O_2, Ar and N_2, 14:31061 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Physics
Acoustic studies of solids, 14:32785 (R;US)

Illinois Univ., Urbana, IL (USA). Nuclear Physics Lab.
Notes on the theory of parallel plate avalanche detectors, 14:31812 (R;US)

Imatran Voima Oy, Helsinki (Finland)
Fault Location in the Finnish transmission network, 14:30813 (R;FI;In Finnish)

Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada)
Study of effective aeolian wind power imparted to single conductor spans, 14:30812 (R;CA)

Institute for Advanced Study, Princeton, NJ (USA)
Problems in particle theory: Progress report, April 30, 1988–April 30, 1989, 14:32543 (R;US)

Institute of Gas Technology, Chicago, IL (USA)
Microbial removal of organic sulfur from coal: Final report, October 1985–September 1988, 14:30262 (R;US)
Thermally initiated carbon-carbon bond-cleavage reactions occurring during coal gasification. Final report, April 1985-June 1988, 14:30265 (R;US)

Institute of Nuclear Physics, Cracow (Poland)
Giant dipole resonances in hot nuclear matter in the model of self-relaxing mean-field, 14:32707 (R;DE)

Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)
Explanations on nomenclature and number of material for steels in accordance with DIN norm - (Deutsch Industrie Norm), 14:31197 (R;BR;In Portuguese)
Influence of radiolytic degradation products from organic phase, 14:31569 (R;BR;In Portuguese)
Influences of the HNO/sub 3/ initial concentration at aqueous phase and the temperature on zirconium extraction, 14:31385 (R;BR;In Portuguese)

Instituto de Fisica Teorica, Sao Paulo, SP (Brazil)
Dynamical breakdown of chiral symmetry in vectorial theories: QED and QCD, 14:32628 (R;BR;In Portuguese)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)
Environmental monitoring program of the uranium enrichment facility Almirante Alvaro Alberto, 14:30624 (R;BR;In Portuguese)
Evaluation of the mass spectrometric isotope dilution technique with the addition of two tracers (/sup 233/U and /sup 235/U) in the determination of the concentration and distribution of uranium in minerals, 14:31390 (R;BR;In Portuguese)
Radiation effects on metals, alloys and cement, 14:31213 (R;BR)
Trace uranium analysis in geological sample by isotope dilution-alpha spectrometry and comparison with other techniques, 14:31391 (R;BR;In Portuguese)

Instituto Superior de Agricultura, Santo Domingo (Dominican Republic)
Fuel wood and charcoal research in the dominican republic. Results of the wood fuel development program, 14:30984 (R;DO)

International Atomic Energy Agency, Vienna (Austria)
Estimation of DNA synthesis in lymphocyte as biological indicator in radiation accidents. Final report for the period 1 November 1986 - 30 November 1988, 14:32758 (R;XA)

International Atomic Energy Agency, Vienna (Austria). Atomic and Molecular Data Unit
International bulletin on atomic and molecular data for fusion. No. 38, 14:32873 (R;XA)

International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee
Evaluated nuclear constants for uranium-236 (Preprint No. 2), 14:32690 (R;XA)
Methods for the calculation of neutron induced reactions, 14:32714 (R;XA)
Multi-step direct multi-step compound description of fast particle induced reactions, 14:32711 (R;XA)
Spectra of inelastically scattered neutrons with an initial energy of 14.1 MeV and nuclear level density, 14:32646 (R;XA)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)

Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)

International Centre for Theoretical Physics, Trieste (Italy)
Erratic time dependence of orbits of topologically mixing maps, 14:32820 (R;XA)
Geologic considerations for urban planning in seismic environment, 14:32420 (R;XA)
Production of light fragments in hA collisions at high energies, 14:32710 (R;XA)

Iowa Dept. of Natural Resources, Des Moines, IA (USA)
Annual report on abandoned or uncontrolled hazardous-waste disposal sites and Hazardous Waste Remedial Fund, 1988, 14:30979 (R;US)
Energy-management financing for state facilities and public schools, 14:30994 (R;US)

Iowa Natural Resources Council, Des Moines, IA (USA)
A process evaluation of the Iowa partnerships in low-income residential retrofit program, 14:31060 (R;US)

Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy
Electron-density depletions in the nightside auroral zone. Progress report, 14:32477 (R;US)
Micron-sized-particle impacts detected near Uranus by the Voyager 2 plasma-wave instrument. Progress report for period ending 1986, 14:32442 (R;US)
Solar-cycle dependence of the radial gradient of cosmic-ray intensity. Progress report for period ending 1988, 14:32441 (R;US)

Istituto Nazionale di Fisica Nucleare, Rome (Italy)
Fifth force, sixth force and all that. A theoretical (classical) approach, 14:32821 (R;IT)
Structure constants of the (A,D) minimal C less than 1 conformal models, 14:32629 (R;IT)
Tracking techniques in underground physics, 14:31813 (R;IT)

J

Jackson State Univ., MS (USA)
Analysis of four selected state-transportation coordinated efforts in social services and rural public transportation. Final report, 14:31099 (R;US)

Joint Inst. for Nuclear Research, Dubna (USSR)
Methods and systems for diagnostics of electron bunches by synchrotron radiation in infrared range, 14:31750 (R;SU;In Russian)
SU(2) lattice gauge theory with an external field, 14:32635 (R;DK)

Jydsk Teknologisk Institut, Aarhus (Denmark)
Quality demands and methods of control in the case of welded plastic-casing pipe joints. Part 1, 14:31334 (R;DK;In Danish)

Jysk Teknologisk, Aarhus (Denmark). Afdelingen for Plastteknik
Adhesion between polyurethane insulation and media tubes, 14:31144 (R;DK;In Danish)
Dynamic characteristics of PUR cellular plastic in pre-insulated district heating pipes, 14:31146 (R;DK;In Danish)

K

Karlsruhe Univ. (T.H.) (Germany, F.R.). Engler-Bunte-Inst. Bereich 1 - Gas, Erdoel und Kohle
Characterisation of novel matrix catalysts and catalyst selectivity control for alpha olefin synthesis on the basis of CO and H/sub 2/, 14:30264 (R;DE;In German)

Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie
Model investigations for trace analysis of iodine, uranium, and technetium in saturated sodium chloride leaching solutions of stored radioactive waste, 14:30565 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Abt. Dekontamination
Investigation of a newly developed, multistage combustion system, 14:31580 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie der Nuklearen Entsorgung
Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik
Fast trigger scintillator for the JETSET experiment (PS202/LEAR), 14:31817 (R;DE;In German)
Interactions between quasiparticles and phonons in odd-even nuclei in the region of /sup 88/Sr and /sup 90/Zr, 14:32735 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung
Stress analysis and review of a prestressed concrete reactor pressure vessel of a HTR 500-type, 14:31323 (R;DE)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe
Fission product release profiles from spherical HTR fuel elements at accident temperatures, 14:30906 (R;DE)
Verification of constitutive equations for application at 850/sup 0/C, using the internal stress concept, 14:31214 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentralabteilung Brennelement- und Bestrahlungstechnologie
Determination of effective cross sections and burnup calculation for HTR-irradiations in a reflector position of the research reactor FRJ-2 (DIDO), 14:30845 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Zentrallabor fuer Elektronik
Detector system for two-dimensional, position-sensitive detection of neutrons and gamma quanta, 14:31816 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Abt. fuer Angewandte Systemanalyse
Analysis of dispersion and deposition of acidifying and phytotoxic air pollutants, 14:31928 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik
Annual report on nuclear physics activities. July 1, 1987 - June 30, 1988, 14:32648 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung
Mechanical properties of lithium silicates for fusion reactor breeder blankets, 14:32922 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik
Gamma irradiation and in-situ corrosion studies on unalloyed steels for a high level waste packaging in a rock salt repository, 14:30566 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie
Model investigations for trace analysis of iodine, uranium, and technetium in saturated sodium chloride leaching solutions of stored radioactive waste, 14:30565 (R;DE;In German)
Stripping voltammetry of technetium(VII) by means of a glassy carbon electrode chemically modified with a TPAC loaded copolymer film, 14:31392 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Isotopentechnik
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion
Mechanical properties of lithium silicates for fusion reactor breeder blankets, 14:32922 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)

Kraftwerk Union A.G., Erlangen (Germany, F.R.)
The Studsvik Super-Ramp Extension Project: Destructive post-irradiation examinations of rod group PK 1X, 14:30836 (R;SE)

Kraftwerk Union A.G., Erlangen (Germany, F.R.). Geschaeftsbereich Kernbrennstoffkreislauf
The Studsvik Super-Ramp Extension Project: Complementary post-irradiation examinations of KWU/CE rods at Karlstein, 14:30829 (R;SE)

Krueger (I.) A/S, Copenhagen (Denmark)
Bio-adsorption (Pilot-scale). Investigation of cleansing effect and sludge formation, 14:31145 (R;DK;In Danish)

L

Lake City Army Ammunition Plant, Independence, MO (USA). Ammunition Technology Div.
Defense Nuclear Agency Fiscal Year 1990/91 program document: research, development, test and evaluation, defense agencies (supports congressional budget estimates), 14:31168 (R;US)

Lawrence Berkeley Lab., CA (USA)
A general formalism for quasi-local correction of multipole distortions in periodic transport systems, 14:31759 (R;US)
A large superconducting detector magnet without an iron return path, 14:31825 (R;US)
A method for sizing sub-micron particles using small angle diffraction of soft x-rays, 14:32801 (R;US)
An end-use approach to development of long-term energy demand scenarios for developing countries, 14:30996 (R;US)
Beam impedance of ferrite kicker magnets, 14:31760 (R;US)
Biomimetic catalysis: Hydroxylation of C_2, C_3, and cycloC_6 hydrocarbons by managanese porphyrin and non-porphyrin catalysts in the presence of monooxygen transfer reagents, 14:30706 (R;US)
Characterization of fracture networks for fluid flow analysis, 14:32433 (R;US)
Concepts, features, and design of a sixteen-to-four beam combiner for ILSE [Induction Linac Systems Experiment], 14:32924 (R;US)
Cryogenic techniques for large superconducting magnets in space, 14:31599 (R;US)
Development of superconducting strand and cable with improved properties for use in SSC [Superconducting Super Collider] magnets, 14:31763 (R;US)
Dynamic aperture of the ALS [Advanced Light Source] booster synchrotron, 14:31762 (R;US)
Electron Energy-Loss Spectroscopy: Fundamentals and applications in the characterization of minerals, 14:31394 (R;US)
Elements of a realistic 17 GHz FEL/TBA design, 14:31697 (R;US)
Energy Analysis Program: Annual report, FY 1988, 14:30971 (R;US)
Environmental research program: FY 1987, annual report, 14:31929 (R;US)
Environmental Research Program: FY 1988 annual report, 14:31931 (R;US)
Following macromolecular interactions and sugar metabolism using site specific ^3H labelling and NMR spectroscopy, 14:32210 (R;US)
Geothermal field case studies that document the usefulness of models in predicting reservoir and well behavior, 14:30772 (R;US)
HIF/HIFAR accomplishments: A synopsis (December 1988), 14:32925 (R;US)
Lithologic composition and variability of the sediments underlying Kesterson Reservoir as interpreted from shallow cores, 14:32417 (R;US)
Magnetic properties of the ALS [Advanced Light Source] booster synchrotron engineering model magnets, 14:31761 (R;US)
Microanalytical and structural characterization of optical materials by electron microscopy and related spectroscopies, 14:31283 (R;US)
On the re-acceleration of bunched beams, 14:31722 (R;US)
Passive superconductor: A viable method of controlling magnetization multipoles in the SSC dipole, 14:31766 (R;US)
Real-time measurement of the size fractionation of aerosol black carbon during the South Coast Air Quality Study, June 13–September 4, 1987, Claremont College, Claremont, California: Final report: Revision, 14:31930 (R;US)
Real-time measurement of the size fractionation of aerosol black carbon during the Southern California Air Quality Study, June 13–September 4, 1987, Claremont College, California, 14:31932 (R;US)
Spontaneous fission of the heaviest elements, 14:32739 (R;US)
Steady-state and impedance analyses of electrochemical kinetics and mass transfer, 14:31551 (R;US)
Straight ends for superconducting dipole magnet using "constant perimeter" geometry, 14:31764 (R;US)
Stress induced microcrack geometry at failure in unconfined and confined axial compressive tests, 14:32432 (R;US)
Symmetry breaking: The standard model and superstrings, 14:32618 (R;US)
The effect of precipitation on contaminant dissolution and transport: Analytic solutions, 14:30567 (R;US)
The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission, 14:32670 (R;US)
The LBL/AGMEF/JSU El Yunque Environmental Research Initiative, 14:31933 (R;US)
The production of beams from solid materials at the LBL ECR source, 14:31758 (R;US)
The sum of megabytes equals gigawatts: Energy consumption and efficiency of office PC's and related equipment, 14:31038 (R;US)
Training of LBL-SSC model dipole magnets at 1.8 K, 14:31765 (R;US)
Vertically integrated simulation tools for self-consistent tracking and analysis, 14:31721 (R;US)
Windows and lighting program: FY 1988, annual report, 14:31069 (R;US)

Lawrence Livermore National Lab., CA (USA)
A hybrid 3 Gs/s, 6-bit digital to analog converter, 14:31678 (R;US)
A second-order projection method for the incompressible Navier Stokes equations on quadrilateral grids, 14:32529 (R;US)
A simple method to remove reference counting in applicative programs, 14:33012 (R;US)
A test of Newton's Law of Gravity using the BREN Tower, Nevada, 14:32842 (R;US)
Absolute intensity, high resolution spectrum of the vortek arc lamp and its spectral match to Nd:YAG bands, 14:31633 (R;US)
Adaptive mesh refinement on moving quadrilateral grids, 14:32530 (R;US)
Aligning the magnetic field of a linear induction accelerator with a low-energy electron beam, 14:31729 (R;US)
An evaluation of cross-borehole resistivity tomography, 14:32423 (R;US)
Applications of large-eddy simulation: Model comparison and calibration: Technical report B048682-1, 14:31911 (R;US)
Assessing tap-water contributions to inhalation exposure for volatile organic chemicals, 14:31094 (R;US)
Atmospheric effects on laser propagation, 14:33031 (R;US)
Beyond CO_2: The other greenhouse gases, 14:31972 (R;US)
Capabilities and some applications of the LLNL 100-kV electric gun, 14:31623 (R;US)
Characterization of radiation boundary conditions used in the finite-difference time-domain method, 14:32840 (R;US)
Climate projections with regional resolution, 14:31976 (R;US)
Cloud albedo, greenhouse effects, atmospheric chemistry, and climate change, 14:31975 (R;US)
Comparison of experimental shock-wave profiles for tungsten and computer simulations using a rate-dependent constitutive model, 14:32802 (R;US)
Criticality benchmarks for COG: A new point-wise Monte Carlo code, 14:32754 (R;US)
Earth Sciences annual report, 1987, 14:30612 (R;US)
ECH on the MTX [Microwave Tokamak Experiment], 14:32886 (R;US)
Energy and Technology Review, February–March 1989, 14:32508 (R;US)
Engineering drawing transfer test with Douglas Aircraft Company: MIL-D-28000 Class II (IGES), 14:33024 (R;US)
Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint, 14:31974 (R;US)
Fission in intermediate energy heavy ion reactions, 14:32681 (R;US)
Gamma ray bursts: Confrontation between theory and observational data, 14:32464 (R;US)
High average-power induction linacs, 14:31707 (R;US)
Institutional research and development, FY 1988, 14:30990 (R;US)
Introduction to background materials for Workshop No. 1: Global climate change and its effects on California, 14:31971 (R;US)
Laboratory observations of the effect of geological discontinuities on hydrofracture propagation, 14:32435 (R;US)

Learning the value of VE, 14:32973 (R;US)
Lightning: Understanding it and protecting systems from its effects, 14:31677 (R;US)
Magnet design technical report—ITER definition phase, 14:32932 (R;US)
Magnetic switching, 14:31783 (R;US)
Mechanism of low-temperature water evolution from Green River Formation oil shale, 14:30394 (R;US)
New electromagnetic directed energy pulses, 14:32839 (R;US)
Numerical modeling of monopoles on radial-wire ground screens, 14:31878 (R;US)
Photon annd pion production in heavy ion collisions, 14:32740 (R;US)
Preliminary assessment of the impact of incorporating a detailed algorithm for the effects of nuclear irradiation on combat crew performance into the Janus combat simulation, 14:33030 (R;US)
Preventing depletion of stratospheric ozone: Implications on future aircraft emissions, 14:31973 (R;US)
Program CICC, flow and heat transfer in cable-in-conduit conductors: Equations and verification, 14:31617 (R;US)
Radiation from waves guided by nonuniform active surfaces, 14:32841 (R;US)
Recent improvements to the model for wire antennas in the code NEC [Numerical Electromagnetics Code], 14:31879 (R;US)
Sensors for in situ monitoring of elastic properties, 14:31622 (R;US)
Simple models for electric gun operating characteristics, 14:31782 (R;US)
Simplified climate models: Rationale and design, 14:31912 (R;US)
Simulations of cloud condensation droplet nucleation and growth, 14:31910 (R;US)
Structural engineering, mechanics and materials: Final report, 14:31618 (R;US)
Switched power workshop: Power supply working group, 14:31784 (R;US)
Technical Abstracts, 1988, 14:31586 (R;US)
The CALS Test Network MIL-D-28000 Class II reference drawing packet: Revision C, 14:33011 (R;US)
The challenge of change for Fortran, 14:33013 (R;US)
Thermal-capillary model with axisymmetric fluid flow for analysis of Czochralski crystal growth of high Prandtl number materials: Final report, 14:31337 (R;US)
Ventilation survey manual: Revision 1, 14:31093 (R;US)
Viscosity of solids determined by shock wave action on hemispherical indentations, 14:31897 (R;US)
Waste package performance assessment for the Yucca Mountain Project, 14:30613 (R;US)
Yucca Mountain Project waste package design for MRS [Monitored Retrievable Storage] system studies, 14:30610 (R;US)
[Symposium on the Auger Effect, Paris, Orsay, and Limeil, France, March 29–30, 1989 and April 3–7 and 20–21, 1989]: Foreign trip report, 14:32492 (R;US)

Lehigh Univ., Bethlehem, PA (USA)
Effects of auxiliary heat treatments on flame-cutting procedures, 14:31190 (R;US)

Lehigh Univ., Bethlehem, PA (USA). Dept. of Materials Science and Engineering
Analytical electron microscopy of catalyst promoters, poisons, and active species: Progress report, [July 1986–September 1988], 14:31470 (R;US)

Lehigh Univ., Bethlehem, PA (USA). Dept. of Physics
Excitation-transfer collisions in cesium vapor: CS(5d (5/2)) + CS(6s (1/2)) yields CS(5d (3/2)) + CS(6s (1/2)), 14:32481 (R;US)

Lehigh Univ., Bethlehem, PA (USA). Zettlemoyer Center for Surface Studies
Infrared study of carbon deposits on bimetallic catalysts: Final report, September 1, 1986–August 31, 1989, 14:31467 (R;US)
Infrared study of carbon on alumina, 14:31182 (R;US)

Lenox Inst. for Research, Inc., MA (USA)
Analytical procedures for environmental quality control. Volume 1. Technical report, 14:32041 (R;US)
Analytical procedures for environmental quality control. Volume 2. Technical report, 14:32042 (R;US)
Analytical procedures for environmental quality control. Volume 3. Technical report, 14:32043 (R;US)

Levelton (B.H.) and Associates Ltd., Vancouver, BC (Canada)
Development of cementitious grouts for post-tensioned concrete members use in offshore structures and in the arctic environment. Vol. 3, Evaluation of pulse-echo technology for detection of voids in grouted ducts, 14:31664 (R;CA)

Lighting Perceptions, Inc., Markham, ON (Canada)
Roadway lighting equipment management systems. Preliminary review: final report synopsis. [B] User standards for luminaire specifications, vol. 1, 14:31140 (R;CA)

Linkoeping Univ. (Sweden). Dept. of Mechanical Engineering
Industrial load management in the Broby area, 14:31031 (R;SE;In Swedish)
Load management - A way of reducing the costs for electric demand at Gustavsberg VVS AB, 14:31115 (R;SE;In Swedish)

Little (Arthur D.), Inc., Cambridge, MA (USA)
Use of gas-turbine exhaust for the direct drying of food products. Final report, 14:31124 (R;US)

Los Alamos National Lab., NM (USA)
A combined thermal/epithermal neutron interrogation device to assay fissle materials in large containers, 14:31598 (R;US)
An imaging detector for neutron or gamma sources, 14:31824 (R;US)
Application of neural networks and other machine learning algorithms to DNA sequence analysis, 14:32174 (R;US)
Assessment of higher-temperature superconductors for utility applications: Final report, 14:30811 (R;US)
Barriers to the nucleation of methyl groups on the diamond (111) surface, 14:31332 (R;US)
Change Control of software at LANL, 14:33004 (R;US)
Characterization of lunar ilmenite resources, 14:32431 (R;US)
Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking, 14:31216 (R;US)
Constellation sizing for modest directed energy platforms, 14:33027 (R;US)
Copper-67 labeled porphyrin localization in inflamed tissues, 14:32349 (R;US)
Design and performance of the 10-kV, 5-MA pulsed-power system for the FRX-C compression experiment, 14:32923 (R;US)
Directed energy weapons–lasers: Ground- and space-based systems, 14:33026 (R;US)
Final state effects in liquid ^{4}He: An experimental test, 14:32506 (R;US)
Goals for limited strategic defenses, 14:31899 (R;US)
High explosives reaction model and its application to booster performance, 14:31894 (R;US)
High precision isotopic analyses of uranium and plutonium by total sample volatilization and signal integration, 14:31473 (R;US)
High-frequency cavity applications and measurements of high-temperature superconductors, 14:31333 (R;US)
Improvements to a transmission-line model of a main-ring cavity, 14:31752 (R;US)
Issues in the sequential deployment of strategic defenses, 14:31900 (R;US)
KIVA-II: A computer program for chemically reactive flows with sprays, 14:31161 (R;US)
Longitudinal emittance in high-current ion accelerators, 14:31720 (R;US)
Minutes of the meeting, Metal Forming Modeling Subgroup of IMOG, February 1988, 14:31215 (R;US)
Momentum distributions: An overview, 14:32835 (R;US)
New energy replacement method for resonant power supplies, 14:31755 (R;US)
Observation of the negative muonium ion in vacuum, 14:32505 (R;US)
Optimization of Resonant Power Supply Circuit, 14:31753 (R;US)
Our 50-year odyssey with fission: Summary, 14:32738 (R;US)
Oxidation of MoS_2 by thermal and hyperthermal atomic oxygen, 14:31331 (R;US)
Photoemission spectroscopy of single crystal HTSC materials: A Fermi liquid electronic structure, 14:31393 (R;US)
Physics Division progress report, October 1, 1986–September 30, 1987, 14:33025 (R;US)
Pion and muon decays beyond the standard model, 14:32589 (R;US)

Potential benefits of distributed PCM thermal, 14:31068 (R;US)
Proceedings of the DOE workshop on the role of a high-current accelerator in the future of nuclear medicine, 14:32348 (R;US)
Process of labeling specific chromosomes using recombinant repetitive DNA, 14:32176 (P;US)
Recent experiments with the free-electron laser at Los Alamos, 14:31628 (R;US)
Scientific considerations in the design of the Mars observer gamma-ray spectrometer, 14:32458 (R;US)
Shock initiation modeling of multicomponent explosives, 14:31893 (R;US)
Spectra of crab-like pulsars: A GRO perspective, 14:32459 (R;US)
Tentative design of beam focusing for the AHF linac and transport systems, 14:31757 (R;US)
The destruction of hazardous chemical waste by oxidation in supercritical water, 14:32036 (R;US)
The dynamical behavior of classifier systems, 14:33001 (R;US)
The future of Chinese science, 14:30988 (R;US)
The proton storage ring: Problems and solutions, 14:31788 (R;US)
Theory of neutron emission in fission, 14:32737 (R;US)
Time and frequency response of beam position monitors at the Los Alamos proton storage ring, 14:31756 (R;US)
Tuning magnet power supply, 14:31754 (R;US)
Use of the delta-t method for setting rf phase and amplitude for the AHF linac, 14:31696 (R;US)
VMS [Virtual Memory Systems] ALAP [Audit Log Analysis Package] 1.0: An automated audit trail analysis tool, 14:33002 (R;US)
Wire chamber assembly techniques: More methods, 14:31823 (R;US)
Xcl—A family of programming lanquage-based shells, 14:33003 (R;US)

Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.
DOE contractors' meeting on chemicals with living systems, 14:32395 (R;US)
Models for pulmonary lethality and morbidity after irradiation from internal and external sources, 14:30909 (R;US)

Lund Univ. (Sweden). Dept. of Automatic Control
Analysis of resonance oscillation of the neutron flow in a BWR-core, 14:30823 (R;SE;In Swedish)

Lund Univ. (Sweden). Dept. of Clinical Physiology
Measurement of regional cerebral blood flow by intravenous administation of 133 xenon. Theory, technique and clinical applications, 14:32360 (R;SE)

Lund Univ. (Sweden). Dept. of Nuclear Physics
Study of beta decay energies and atomic masses, 14:32673 (R;SE)

Lund Univ. (Sweden). Dept. of Physics
Calibration of imaging laser-induced fluorescence measurements in highly absorbing flames: an analytical reconstruction method, 14:31581 (R;SE)
Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)

Lund Univ. (Sweden). Dept. of Theoretical Physics
Coherence effects in parton showers, 14:32590 (R;SE)

Lund Univ. (Sweden). Max-laboratory
Installation of a ferrite undulator in the MAX storage ring, 14:31789 (R;SE)

M

Macro Engineering Consultants, Vancouver, BC (Canada)
Low pressure sodium roadway lighting, 14:31141 (R;CA)

Main (Charles T.), Inc., Charlotte, NC (USA)
Selection of materials for Savannah River Site Consolidated Incinerator Facility (CIF) offgas system, 14:30616 (R;US)

Mainz Univ. (Germany, F.R.)
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)

Manitoba Dept. of Energy and Mines, Winnipeg, MB (Canada)
Supplementary information for legislative review, 1988-89 estimates, 14:30998 (R;CA)

Manitoba Univ., Winnipeg, MB (Canada). Dept. of Botany
Peatland inventory of Manitoba. 3. Interlake region using Landsat v thematic mapper, 14:30277 (R;CA)

Martin Marietta Environmental Systems, Columbia, MD (USA)
Chesapeake Bay mainstem monitoring program statistical and analytical support contract: final report, Volume 1, 14:32039 (R;US)
Chesapeake bay mainstem monitoring program statistical and analytical support contract: final report, volume 2, 14:32040 (R;US)

Maryland Univ., College Park, MD (USA). Dept. of Computer Science
Using control states for parallelism extraction. Final report, 1 March 1987-30 June 1988, 14:32979 (R;US)

Maryland Univ., College Park, MD (USA). Dept. of Mechanical Engineering
The use of stereo optical flow fields in the determination of three-dimensional motion and stereo correspondence: Progress report, May 1988–April 1989, 14:31595 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Materials Science and Engineering
Evidence against the existence of strong diffuse x-ray scattering from gold twist boundaries at room temperature, 14:32786 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center
Waves and instabilities in noneutral plasmas, 14:32864 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics
R-f spectroscopy of trapped neutral atoms, 14:32487 (R;US)
Theoretical studies and algorithm development for x-ray lasers: Final report, June 15, 1988–February 15, 1989, 14:31634 (R;US)

Matrecon, Inc., Alameda, CA (USA)
Liner-waste compatibility studies for coal-fired power plants, 14:31112 (R;US)

MCR Technology Corp., Chicago, IL (USA)
Development of an efficient high-brightness Ti:Al_2O_3 laser amplifier. Final report, 15 August 1987-14 February 1988, 14:31626 (R;US)

Memorial Univ. of Newfoundland, St. John's (Canada). Centre for Cold Ocean Resources Engineering
Evaluation of two search radar systems for detection of ice masses, 14:31669 (R;CA)
Feasibility study of full scale iceberg impact tests, 14:31687 (R;CA)

Mercy Hospital and Medical Center, Chicago, IL (USA)
Fuel peat in Newfoundland, 14:30280 (R;CA)
Large scale wood heating, 14:30673 (R;CA)

Michigan State Univ., East Lansing, MI (USA)
Role of acyl carrier protein isoforms in plant lipid metabolism: Progress report, 14:32173 (R;US)

Michigan Technological Univ., Houghton, MI (USA). Dept. of Metallurgical Engineering
Stress corrosion cracking and metal-induced embrittlement: Local chemistry and local plasticity: Progress report, September 1, 1986–October 31, 1988, 14:31192 (R;US)

Michigan Univ., Ann Arbor, MI (USA). Coll. of Engineering
Nonlinear viscoelastic characteristics of polymeric materials: Final report, September 1, 1986–February 28, 1989, 14:31319 (R;US)

Midwest Research Inst., Kansas City, MO (USA)
Risk-assessment methodology for hazardous-waste management. Final report, 14:31126 (R;US)

Miljoe- og Energikontoret, Copenhagen (Denmark)
Humleby's heating supplies. Investigation of the possibilities for establishing local heat supply based on renewable energy in the Humleby area, 14:31147 (R;DK;In Danish)

Minas Gerais Univ., Belo Horizonte (Brazil)
Influences of deformation velocity and temperature on localized deformation of zircaloy-4 in tensile tests, 14:31209 (R;BR;In Portuguese)

Minas Gerais Univ., Belo Horizonte (Brazil). Dept. de Fisica
Proceedings of the 4. Brazilian School of Semiconductor Physics, 14:32787 (R;BR;In Portuguese)

Ministerio das Minas e Energia, Brasilia, DF (Brazil)
National Energy Balance - 1980, 14:31037 (R;BR;In Portuguese)
National Energy Balance - 1982, 14:32969 (R;BR;In Portuguese)

Missouri Univ., Rolla, MO (USA)
Transient liquid crystals in a W/O microemulsion, 14:30290 (R;US)

Montgomery (James M.) Consulting Engineers, Inc., Pasadena, CA (USA). Montgomery Labs.
Evaluation of the secondary effects of air stripping, 14:32044 (R;US)
Montreal Univ., PQ (Canada). Centre de Recherche sur les Transports
A computer system for the design and experimentation of routing algorithms, 14:31096 (R;CA)
Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin
Experimental study on the usefulness of magnetotherapy in bone fractures (tibial osteotomy in the rat). Accumulation of 99 mTc MDP - tests of tensile strength - determination of alkaline phosphatase, 14:32209 (R;DE;In German)
Measurements of regional cerebral blood flow (rCBF) using dynamic single-photon emission computed tomography (DSPECT): Definition of a generally acceptable normal range and follow-up checks after extracranial bypass surgery, 14:32343 (R;DE;In German)
Results of postoperative radiotherapy and radiation of recurrent tumours, observed in adenomas of the pituitary gland operated at a primary stage, 14:32344 (R;DE;In German)
Muenchen Univ. (Germany, F.R.). Fakultaet fuer Physik
Observation of CHI/sub b/ and CHI/sub b/' production in exclusive decays of the Y' and Y" with the CUSB detector at the Cornell e/sup +/e/sup -/ storage ring, 14:32547 (R;DE)
Theory of the critical X-ray and neutron scattering at surfaces, 14:32798 (R;DE;In German)
Muenster Univ. (Germany, F.R.). Inst. fuer Kernphysik
Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)

N

National Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie K
Investigation into modulators. Progress report, 14:31790 (R;NL;In Dutch)
National Board for Spent Nuclear Fuel, Stockholm (Sweden)
Psychological aspects of nuclear waste disposal: Long time perception and the question of discounting of risks, 14:30606 (R;SE)
Time orientation, planning horizons and responsibility into the future, 14:30605 (R;SE)
National Consumer Law Center, Washington, DC (USA)
State uses of Exxon and Stripper Well oil overcharge funds: Status report No. 3, 14:30306 (R;US)
National Energy Board, Ottawa, ON (Canada)
Canadian energy supply and demand, 1987-2005. Summary, 14:30997 (R;CA;In French)
Natural gas market assessment, 14:30319 (R;CA)
National Geophysical Data Center, Boulder, CO (USA)
Solar-Geophysical Data Number 438, February 1981. Part 2 (comprehensive reports). Data for August 1980 and miscellanea, 14:32461 (R;US)
National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)
Health-hazard evaluation determination report No. 75-87-280, Kawecki Berylco Industries, Inc., Reading, PA, 14:31943 (R;US)
Health-hazard evaluation determination report No. 76-33-431, 76-34-431, Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia, 14:31944 (R;US)
Health-hazard evaluation determination report No. 75-121-281, Penn Central Transportation Company, Philadelphia, Pennsylvania, 14:31946 (R;US)
Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana, 14:31947 (R;US)
Health-hazard evaluation determination report No. 77-44-435, Keller Columbus, Inc., Columbus, Ohio, 14:31948 (R;US)
Health-hazard evaluation determination report No. 75-19-276, Masonite Corporation, Evendale, Ohio, 14:31959 (R;US)
Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri, 14:31960 (R;US)
Health-hazard evaluation determination report No. 74-9-174 Wheeling Steel Corporation, Steubenville, Ohio, 14:31961 (R;US)
Health-hazard evaluation determination report No. 73-123-298, Campbell Plastics, Inc., Schenectady, New York, 14:31962 (R;US)
Health-hazard evaluation determination report No. 76-6-294, J. A. Devine, D.D.S., Cheyenne, Wyoming, 14:31963 (R;US)
Health-hazard evaluation determination report No. 75-146-254, Custom Furniture and Cabinets, Inc., Post Falls, Idaho, 14:31964 (R;US)
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Industrial-hygiene survey report, Cain Chemical, Inc., Bayport Plant, Pasadena, Texas, June 1-2, 1988, 14:31953 (R;US)
Industrial-hygiene survey report, P. D. George Company, St. Louis, Missouri, February 22-25, 1988, 14:31954 (R;US)
Industrial-hygiene survey report, Wabash Magnetic Company, Huntington, Indiana, May 24-26, 1988, 14:31955 (R;US)
Industrial-hygiene survey, Bachmeier and Company, Kearny, New Jersey, November 4-8, 1985, 14:31952 (R;US)
Walk-through survey report, Central Brass Manufacturing Company, Cleveland, Ohio, March 20, 1987, 14:31956 (R;US)
National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)
Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Detailed separation and analysis of basic compounds, 14:30312 (R;US)
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)
High-temperature heat-capacity measurements and critical property determinations using a Differential Scanning Calorimeter: Results of measurements on toluene, tetralin, and JP-10, 14:30313 (R;US)
Integrated reservoir assessment and characterization: Final report, October 1, 1985–September 30, 1988, 14:30293 (R;US)
Surfactant loss: Effects of temperature, salinity, and wettability, 14:30292 (R;US)
National Inst. of Radiation Protection, Stockholm (Sweden)
Chemical risks from nuclear waste repositories, 14:30626 (R;SE)
Chernobyl - radioactivity in sludge produced in wastewater treatment plants, 14:30924 (R;SE;In Swedish)
Disposal of radioactive waste in land burial facilities at Studsvik. Inspection notes, 14:30641 (R;SE;In Swedish)
English translation of three documents relating to the SFR-1. Operating permission. Radiation protection instructions. Chapter 4 of the assessment memorandum, 14:30607 (R;SE)
Intercalibration measurements of gamma radiating nuclides, 14:30888 (R;SE;In Swedish)
Land burial facility at the Forsmark plant. Inspection notes, 14:30640 (R;SE;In Swedish)
Medical consequences of a nuclear plant accident, 14:30925 (R;SE;In Swedish)
Nuclear power industry: Activity emissions, occupational exposures, 14:32780 (R;SE;In Swedish)
Radon decay product in-door behavior - parameter, measurement method, and model review, 14:31856 (R;SE)
What did they say? on radio and TV about Chernobyl and how did we experience the information?, 14:30923 (R;SE;In Swedish)
National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst.
Interaction of plasma-sprayed YBa/sub y/Cu/sub 3/0/sub x/ coatings with alumina substrates, 14:31284 (R;CA)
National Research Council of Canada, Ottawa, ON (Canada). Div. of Building Research
ENCORE-CANADA. Computer program for the study of energy consumption of residential buildings in Canada, 14:31070 (R;CA)
The development of services for the transfer of technical information on building, 14:33020 (R;CA)
National Research Council, Washington, DC (USA)
Mobile electric power technologies for the Army of the future: engines, power source, and electrical aspects, 14:31005 (R;US)

National Research Council, Washington, DC (USA). Transportation Research Board
Commuter, regional, and rail transit: research and analysis. Transportation Research Record, 14:31100 (R;US)
Issues in environmental analysis. Transportation Research Record, 14:31102 (R;US)
Transit management and replacement capital planning. Transportation research record, 14:31101 (R;US)
Transportation planning and automated guideways. Transportation research record, 14:31103 (R;US)

National Swedish Environmental Protection Board, Solna (Sweden)
Biological and radioecological investigations at Ringhals nuclear power plant 1968-1987, 14:30887 (R;SE;In Swedish)
Forest liming in small catchment areas. Background information and preliminary results on liming effects 1983-1987, 14:32004 (R;SE)
Influence of cooling water outlet of the Ringhals power plant on the coastal fish colony, 14:30886 (R;SE;In Swedish)
Radioecologic control of the surroundings of the Ringhals nuclear power station up to and incl. 1986, 14:32779 (R;SE;In Swedish)
Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)
Sulphate stores and sulphate adsorption capacity of the spodic B horizon of Swedish forest soils, 14:32003 (R;SE)

National Swedish Environmental Protection Board, Uppsala
Defoliation of coniferous trees. Assessments 1984-1987, 14:32401 (R;SE)

National Technical Information Service, Springfield, VA (USA)
Asbestos exposure: health effects. January 1985-April 1989 (Citations from the Biobusiness data base). Report for January 1985-April 1989, 14:32400 (R;US)
Carbon monoxide sensors. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:32411 (R;US)
Ceramics technology: automotive gas-turbine-engine component applications. January 1976-April 1989 (Citations from the NTIS data base). Report for January 1976-April 1989, 14:31285 (R;US)
Chemical and biological warfare: defoliants and herbicides. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31474 (R;US)
Chemical and biological warfare: protection, decontamination, and disposal. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989, 14:31601 (R;US)
Chernobyl nuclear reactor accident fallout: measurement and consequences. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:30919 (R;US)
Digital-image archiving systems in diagnostic radiology: picture-archiving and communication systems. January 1975-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-April 1989, 14:32353 (R;US)
Hazardous-materials transportation. January 1977-April 1989 (Citations from the NTIS data base). Report for January 1977-April 1989, 14:30981 (R;US)
Laser mirrors. January 1975-August 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1987, 14:31629 (R;US)
Laser mirrors. September 1987-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for September 1987-April 1989, 14:31630 (R;US)
Leachate treatment. January 1972-April 1989 (Citations from Pollution Abstracts). Report for January 1972-April 1989, 14:32000 (R;US)
Magnesium batteries. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:30962 (R;US)
Metals recovery from wastes. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:31127 (R;US)
Micro-alloying of steels. February 1977-April 1989 (Citations from the COMPENDEX data base). Report for February 1977-April 1989, 14:31223 (R;US)
National Acid Precipitation Assessment Program (NAPAP): pollutant emission inventories available on tape inventories. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31965 (R;US)
Nonionizing electromagnetic radiation: biological effects. January 1972-April 1989 (Citations from the International Aerospace Abstracts data base). Report for January 1972-April 1989, 14:32407 (R;US)
Nuclear warfare: survival. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31902 (R;US)
Packaging-materials biodegradation. January 1973-April 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-April 1989, 14:30982 (R;US)
Superconducting magnetic energy storage (SMES). January 1972-April 1989 (Citations from the NTIS database). Report for January 1972-April 1989, 14:31602 (R;US)
Thermal-barrier coatings: coating methods, performance, and heat-engine applications. July 1982-April 1989 (Citations from the EI Engineering Meetings data base). Report for July 1982-April 1989, 14:31222 (R;US)
Thermal-insulating coatings. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:31286 (R;US)
Water hammer in piping. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:31656 (R;US)

Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (NAGRA), Baden (Switzerland)
Investigations of hydrogen generation by iron corrosion under repository conditions, 14:31217 (R;CH;In German)

Naval Postgraduate School, Monterey, CA (USA)
Comparison of several iterative techniques in the solution of symmetric banded equations on a two-pipe Cyber 205. Technical report, 1 October 1987-30 September 1988, 14:32975 (R;US)
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)

Netherlands Energy Research Foundation, Petten (Netherlands)
EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)
Location-independent study concerning the construction, operation and closure of possible facilities for the final storage of radioactive waste in rock-salt formations in the Netherlands. Executed by Van Hattum and Blankevoort asked for by the Netherlands Energy Research Foundation and subsidized by the Ministry of Economic Affairs, 14:30564 (R;NL;In Dutch)
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)

Nevada Nuclear Waste Project Office, Carson City, NV (USA)
Environmental program planning for the proposed high-level nuclear waste repository at Yucca Mountain, Nevada: Volume 1, 14:30528 (R;US)

Nevada Univ., Las Vegas, NV (USA). Desert Research Inst.
Community Radiation Monitoring Program annual report, October 1, 1987–September 30, 1988, 14:31982 (R;US)

New Brunswick Dept. of Natural Resources and Energy, Fredericton, NB (Canada). Minerals and Energy Div.
Reclamation options for abandoned commercial peatlands, 14:30276 (R;CA;In English and French)

New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center
Improvement of CO_2 flood performance: Quarterly report, October–December 1988, 14:30291 (R;US)

New York Univ., NY (USA). Courant Inst. of Mathematical Sciences
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32700 (R;US)
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32701 (R;US)
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32702 (R;US)

Niels Bohr Inst., Copenhagen (Denmark)
Error estimates on averages of correlated data, 14:33005 (R;DK)
Random dynamics and relations between the number of fermion generations and the fine structure, 14:32591 (R;DK)

Schwinger-Dyson equations as supersymmetric Ward identities, 14:32619 (R;DK)
SU(2) lattice gauge theory with an external field, 14:32635 (R;DK)

Niro Atomizer A/S, Soeborg (Denmark)
Building constructions using cement containing a desulfurization product, 14:31116 (R;DK;In Danish)

Nordvestjysk Folkecenter for Vedvarende Energi, Hurup (Denmark)
Inexpensive selective absorber produced in Denmark, 14:30757 (R;DK;In Danish)

Norges Teknisk-Naturvitenskapelige Forskningsraad, Oslo (Norway)
Programme for marine structures. Summary report, 14:31688 (R;NO)

Norsk Inst. for Luftforskning, Lillestroem (Norway)
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)

North Carolina Central Univ., Durham, NC (USA). Dept. of Physics
Dielectric measurements of selected ceramic materials at 245 ghz, 14:31267 (R;US)

North Carolina State Univ., Raleigh, NC (USA)
Architectural considerations, software support, and compiler issues in multi-computer implementation. Final report, 5 September 1985-31 October 1988, 14:32976 (R;US)
The study of structure-processing-property relations in copper oxide-based high T_c superconductors: Progress report, July 1, 1988–March 1, 1989, 14:31278 (R;US)

North Carolina State Univ., Raleigh, NC (USA). Dept. of Chemical Engineering
Radiation-induced polymerization of cyclophosphazene trimers. Final report, 1 September 1985-30 September 1988, 14:31568 (R;US)

North Carolina State Univ., Raleigh, NC (USA). Dept. of Materials Science and Engineering
Effect of strain rate on the electroplastic effect in Nb, 14:31176 (R;US)

North Carolina Univ., Chapel Hill, NC (USA). School of Public Health
Validation testing of new mechanisms with outdoor chamber data, 14:31938 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 1: comparison of CB4 and CAL mechanisms. Final report, April 1986-September 1988, 14:31939 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 3: calculation of photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31941 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 4: appendixes to photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31942 (R;US)

North Dakota Univ., Grand Forks, ND (USA). Dept. of Chemistry
Metal arene complexes in coal structure determination: Quarterly reports, September 1988–February 1989, 14:30270 (R;US)

North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center
Industrial market assessment of the products of mild gasification: Final report, 14:30251 (R;US)

Northern Territory Dept. of Mines and Energy, Darwin (Australia)
Application of best practicable technology to water management at Ranger Uranium mine: report of the technical working group, 14:30623 (R;AU)
Prospects for Australian involvement in the nuclear fuel cycle, 14:30453 (R;AU)

Northwest Economic Associates, Vancouver, WA (USA)
The role of electricity in Pacific Northwest irrigated agriculture: Volume 2, Background materials and support documents: Sections A–C, 14:31107 (R;US)
The role of electricity in Pacific Northwest irrigated agriculture: Volume 2, Background materials and support documents: Sections D–G, 14:31108 (R;US)

Northwestern Univ., Evanston, IL (USA). Dept. of Materials Science and Engineering
Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988, 14:31175 (R;US)

Notre Dame Univ., IN (USA)
Scintillating fiber detector development for the SSC: Annual progress report, 14:31810 (R;US)

Nova Scotia Ministry of the Environment, Halifax, NS (Canada)
The Minister's Task Force on Litter Abatement. Report, 14:31148 (R;CA)

NTS Engineering, Long Beach, CA (USA)
Seismic margin assessment of the Catawba Nuclear Station: Volume 2, Appendixes: Final report, 14:30902 (R;US)

Nuclear Assurance Corp., Norcross, GA (USA)
Evaluation of potential benefits of transportable storage casks: Final report, 14:30822 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA)
Workshop on rules for exemption from regulatory control: Proceedings, 14:30634 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and Systems Technology
Evaluation of non-radiological water chemistry at power reactors, 14:30824 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services
Title list of documents made publicly available, March 1–31, 1989, 14:30853 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Accident Analysis
Numerical simulation of natural circulation phenomena in a PWR during TMLB' transients prior to core damage, 14:30877 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications
Inhaled ^{147}Pm and/or total-body gamma radiation: Early mortality and morbidity in rats, 14:32376 (R;US)
Models for pulmonary lethality and morbidity after irradiation from internal and external sources, 14:30909 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Information Resources Management
Licensed operating reactors: Status summary report data as of March 31, 1989, 14:30820 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation
Safety Evaluation Report related to the operation of Seabrook Station, Units 1 and 2 (Docket Nos. 50-443 and 50-444), 14:30908 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of the General Counsel
United States Nuclear Regulatory Commission staff practice and procedure digest: Commission, Appeal Board and Licensing Board decisions, July 1972–September 1988, 14:30852 (R;US)

O

Oak Ridge Gaseous Diffusion Plant, TN (USA)
A computer program for simulating the atmospheric dispersion of UF_6 and other reactive gases having positive, neutral, or negative buoyancy, 14:31907 (R;US)
HTAS2: A three-dimensional transient shipping cask analysis tool, 14:31597 (R;US)
Issues and approaches for electronic document approval and transmittal using digital signatures and text authentication, 14:32999 (R;US)
UF-6 cylinder overpack phenolic foam drop tests, 14:30448 (R;US)

Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div.
Fundamentals of uranium enrichment: Part 3, Advanced separation theory: Multicomponent isotope separation: Nuclear fuel cycle training course, 14:30433 (R;US)

Fundamentals of uranium enrichment: Part 4, Other methods; foreign activities: Nuclear fuel cycle training course, 14:30434 (R;US)
Nondestructive assay measurements of gaseous diffusion process equipment, 14:30625 (R;US)

Oak Ridge National Lab., TN (USA)
1987 Neutron and gamma personnel dosimeter intercomparison study using a D_2O-moderated ^{252}Cf source, 14:31848 (R;US)
A cask maintenance facility feasibility study, 14:30525 (R;US)
A remote host facility for Intel hypercubes, 14:33007 (R;US)
A theoretical investigation of a parallel genetic algorithm, 14:32985 (R;US)
Adequacy of forestry data in assessing the impact of ozone: A national perspective, 14:31921 (R;US)
An expert system for correlation of radar and passive sensor signals, 14:32988 (R;US)
An expert system to facilitate selecting a database management system, 14:32989 (R;US)
An orthogonal collocation approach to modeling multicomponent adsorption in carbon beds, 14:32037 (R;US)
Analysis and control of a three-degree-of-freedom robot platform, 14:31594 (R;US)
Atomic physics using large electrostatic accelerators, 14:32490 (R;US)
Benefits and costs of small, short-lead-time power plants and demand-site programs in an era of load-growth uncertainty, 14:30797 (R;US)
Biological (molecular and cellular) markers of toxicity: Semiannual technical progress report (No.1), October 1, 1988–March 31, 1989, 14:32399 (R;US)
CALOR89: The code system for calorimeter analysis and design, 14:31808 (R;US)
Ceramic Technology for Advanced Heat Engines Project data base: September 1988 summary report, 14:31159 (R;US)
Coal solubilization by enhanced enzyme activity in organic solvents, 14:30247 (R;US)
Coal solubilization by lower fungi, 14:30248 (R;US)
Compendium of technical computer codes used in support of the DOE Office of Civilian Radioactive Waste Management, 14:30571 (R;US)
Construction of a simplified wood gas generator for fueling internal combustion engines in a petroleum emergency, 14:30674 (R;US)
Countermeasures to hazardous chemicals, 14:31936 (R;US)
Criteria for selecting a CO_2/climate change region of study, 14:31920 (R;US)
Criticality experiments with a mixed oxide fuel pin array in plutonium-uranium nitrate solutions, 14:30440 (R;US)
Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)
Detectors for the Superconducting Super Collider, design concepts, and simulation, 14:31807 (R;US)
Detectors for the superconducting super collider, design concepts, and simulation, 14:31849 (R;US)
Determination of the mechanical properties of diamond and diamond-like films by the ultra-low load indentation technique, 14:31317 (R;US)
Effects of irradiation on K_{Ic} curves for high-copper welds, 14:31183 (R;US)
Environmental Sciences Division annual progress report for period ending September 30, 1988, 14:31937 (R;US)
Equilibrium and ideal stability studies for ATF, 14:32863 (R;US)
Evaluation of the IBM token-ring network via the proposed standard wiring plan, 14:33008 (R;US)
Fate and effects of PAHs in the terrestrial environment: An overview, 14:31995 (R;US)
Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)
Free-ranging dogs and cats on the Oak Ridge Reservation: Situation and solution, 14:32409 (R;US)
Fundamentals of uranium enrichment: Part 1, Separation theory: Nuclear fuel cycle training course, 14:30432 (R;US)
High resolution subsurface imaging with geophysical diffraction tomography, 14:32419 (R;US)
HISTRAP [Heavy Ion Storage Ring for Atomic Physics] prototype hardware studies, 14:31786 (R;US)
Human factors issues related to expert systems for electric power plant control rooms, 14:30791 (R;US)
Hydraulic control rod drive for water-cooled nuclear reactors, particularly heating reactors, 14:30825 (TG;US)
ICRF Faraday shield plasma sheath physics: The Perkins paradigm, 14:32901 (R;US)
Identification of a non-specific inhibitor of [methyl^{3}H]thymidine incorporation into DNA of normal and pre-neoplastic cells, 14:32211 (R;US)
Investigation of metered data analysis methods for commercial and related buildings, 14:31071 (R;US)
Isotopes: Products and services, 14:31575 (R;US)
Magnetic fluctuations due to pressure driven instabilities in ATF, 14:32862 (R;US)
Mathematical modeling of roof systems, 14:31057 (R;US)
Measured damping and modulus of composite cylinders, 14:31662 (R;US)
Metals and Ceramics Division progress report for period ending September 30, 1988, 14:31174 (R;US)
Modeling the design and operations of the federal radioactive waste management system, 14:30523 (R;US)
ORMONTE: A PC code for cost/risk analysis, 14:32983 (R;US)
Pilot-scale testing of a fuel oil-explosives cofiring process for recovering energy from waste explosives: Final report, 14:31901 (R;US)
Results of the independent radiological verification survey of the lower Sheffield Brook floodplain, Wayne, New Jersey, 14:32021 (R;US)
Results of the independent verification of radiological remedial action at 480 South Main Street, Monticello, Utah (MS00049), 14:32022 (R;US)
Risk associated with the demilitarization of the United States chemical weapons stockpile, 14:31167 (R;US)
Shield optimization program: Part 5, A hydrodynamic comparison using HULL and PUFF-TFT for a one-dimensional aluminum slab, 14:33029 (R;US)
Shield optimization program, Part I: Executive summary, 14:33028 (R;US)
Simple method for calculating island widths, 14:32900 (R;US)
Sources and areal distribution of trace metals in recent sediments of Middle Loch, Pearl Harbor (Hawaii), 14:32038 (R;US)
Systems approach to project management, 14:32965 (R;US)
The dynamic duo: New technology and willing staff, 14:32966 (R;US)
The effect of nitrogen accumulation and nitrification on soil chemical properties in alder forests, 14:30701 (R;US)
The Roof Research Center: A national user facility for thermal performance and durability of roofing systems: Users manual, 14:31072 (R;US)
TNT metabolites in animal tissues: Quarterly technical progress report No. 2, January 1, 1989–March 31, 1989, 14:32398 (R;US)
Tumulus Disposal Demonstration Project assessment plan for potential worker exposure: Revision 1, 14:30570 (R;US)
Wall conditioning in ATF [Advanced Toroidal Facility], 14:32899 (R;US)

Oak Ridge National Lab., TN (USA). Carbon Dioxide Information Analysis Center
Data Inventory System (DIS): A user's guide and programmer's manual, 14:33021 (R;US)

Oak Ridge National Lab., TN (USA). Computing and Telecommunications Div.
Multicode comparison of selected source-term computer codes, 14:30569 (R;US)

Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna (Austria)
4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook, 14:32377 (R;AT;In German, English)

Office of the Supervising Scientist for the Alligator Rivers Region, Sydney (Australia)
Application of best practicable technology to water management at Ranger Uranium mine: report of the technical working group, 14:30623 (R;AU)

Ohmstede (William D.), Las Cruces, NM (USA)
Applications of large-eddy simulation: Model comparison and calibration: Technical report B048682-1, 14:31911 (R;US)

Ontario Hydro Research Div., Toronto, ON (Canada)
Aeolian vibration excitation of bundle conductors. Vol. 1 and 2, 14:30815 (R;CA)
Behavioural systems to guide or divert fish at hydro-electric facilities, 14:30699 (R;CA)
Development of a prototype robotic system for the in-situ repair of hydraulic turbine runners, 14:31671 (R;CA)
Development of improved sheath cross-bonding joint protectors for self-containing underground cables, 14:30814 (R;CA)
Electrical parameters of large turbo-generators, 14:30796 (R;CA)
The electrical characteristics of wood poles, 14:32404 (R;CA)

Ontario Hydro, Toronto, ON (Canada). Economics and Forecast Div.
Alternative scenarios for corporate planning, 14:30976 (R;CA)
Cost escalators. Annual review, 14:31032 (R;CA)
Long-term economic outlook. Annual review, 14:30975 (R;CA)
Prediction ranges. Annual review, 14:30974 (R;CA)
Short-term economic outlook. Annual review, 14:30973 (R;CA)

Ontario Ministry of Agriculture and Food, Guelph, ON (Canada). Agricultural Energy Centre
Development of technology to utilize existing tobacco kilns and/or tobacco storage barns for curing (drying) and/or storage of other crops, 14:31118 (R;CA)
Microprocessor environmental control in a large farrowing complex, 14:31117 (R;CA)

Ontario Ministry of Energy, Toronto, ON (Canada)
A technology status report energy usage and microwave heating potential in Ontario ceramics industry, 14:31120 (R;CA)
Field testing and monitoring of two high efficiency condensing gas boilers installed in a highrise building, 14:31682 (R;CA)
Ontario Ministry of Energy annual report, 1987/88, 14:31001 (R;CA;In English and French)
Radiant wave technology. As a source of energy savings, 14:31119 (R;CA)
Small hydro '88. An international conference and trade show. Proceedings, vol. 1, 14:30676 (R;CA)

Ontario Ministry of the Environment, Toronto, ON (Canada)
Air quality survey in the vicinity of the Petro-Canada Trafalgar Refinery, Oakville, Ontario, 14:30305 (R;CA)
Ambient air quality during the pre start up period of the Victoria Hospital energy-from-waste plant, 14:31934 (R;CA)
Ontario inventory of approved PCB storage sites, 14:31996 (R;CA)

Ontario Ministry of the Environment, Toronto, ON (Canada). Acid Precipitation in Ontario Study
Acid precipitation in Ontario study, annual program report, 1987/1988, 14:31935 (R;CA)

Ontario Research Foundation, Mississauga, ON (Canada). Engineering Sciences Div.
An investigation into the state-of-the-art of dielectric heating applications for lamination, 14:31121 (R;CA)

Ontario Research Foundation, Sheridan Park, ON (Canada)
Effect of CO/sub 2/ on seamless and tubular goods, 14:31219 (R;CA)
Effect of CO/sub 2//H/sub 2/S on seamless and ERW tubular goods, 14:31220 (R;CA)
Proceedings of the fourth Windsor workshop on alternative fuels, 14:31154 (R;CA)

Ontario Research Foundation, Toronto, ON (Canada)
Development of design guidelines and practices for improving residential service entrances, 14:30816 (R;CA)

OPUS Corp., Gaithersburg, MD (USA)
Improving public awareness of the importance of coal and clean coal technology, 14:30283 (R;US)

Oregon Univ., Eugene, OR (USA)
Geometrical scaling, furry branching and minijets, 14:32583 (R;US)

P

Pacific Northwest Lab., Richland, WA (USA)
40 CFR 265 interim status indicator-evaluation ground-water monitoring plan for the 216-B-63 trench, 14:32001 (R;US)
Biological testing of sediment for the Olympia Harbor Navigation Improvement Project, 1988: Geoduck, amphipod, and echinoderm bioassays, 14:32046 (R;US)
Borehole summary report for five ground-water monitoring wells constructed in the 1100 Area, 14:31967 (R;US)
Evaluation of DOE's Partnership in Low-Income Residential Retrofit (PILIRR) Program, 14:31075 (R;US)
Fabrication of lithium ceramic pellets, rings and single crystals for irradiation in BEATRIX-II, 14:32927 (R;US)
Hanford environmental dose reconstruction project: Monthly report, 14:32390 (R;US)
Hanford Environmental Dose Reconstruction Project: Monthly report, May 1989, 14:32391 (R;US)
Inhaled ^{147}Pm and/or total-body gamma radiation: Early mortality and morbidity in rats, 14:32376 (R;US)
Leach testing of simulated Hanford Waste Vitrification Plant reference glass HW-39, 14:30573 (R;US)
Lessons learned from monitoring electricity use in multifamily residences: End-Use Load and Consumer Assessment Program (ELCAP), 14:31036 (R;US)
Models for pulmonary lethality and morbidity after irradiation from internal and external sources, 14:30909 (R;US)
Molecular characterization of x-ray induced mutations at the HG-PRT locus in plateau phase Chinese hamster ovary cells: Effect of dose, dose fractionation, and delayed plating, 14:32393 (R;US)
Pacific Northwest Laboratory annual report for 1988 to the DOE Office of Energy Research: Part 3, Atmospheric sciences, 14:31986 (R;US)
Process simulation and statistical approaches for validating waste form qualification models, 14:30572 (R;US)
Radiation effects on time-dependent deformation: Creep and growth, 14:31224 (R;US)
Technical basis for internal dosimetry at Hanford, 14:32392 (R;US)
The MAP3S Precipitation Chemistry Network: Data and quality control summary for 1986 and 1987, 14:31968 (R;US)
Tritium distribution modeling in a Light Water New Production Reactor, 14:30894 (R;US)
Well installation and ground-water sampling plan for 1100 Area environmental monitoring wells, 14:31966 (R;US)

Paris-11 Univ., 91 - Orsay (France)
Study of the e/sup +/e/sup -/ annihilation reaction into four leptons, 14:32634 (R;FR;In French)
Study of the electromagnetic response functions and momentum distributions of large linear momentum protons in the helium-3 nucleus using inelastic electron scattering, 14:32651 (R;FR;In French)

Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire
Contribution of the final state interactions to the suppression of the J/PSI meson produced in high-energy nucleus-nucleus collisions, 14:32732 (R;FR)
Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)
Neutron-hole strengths and core-coupling in /sup 87/Sr via the /sup 88/Sr(/sup 3/He, α)/sup 87/Sr reaction, 14:32664 (R;FR)

Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire
Depolarization enhancement due to the energy spread, 14:31719 (R;FR)
Effect of the fringing field in sector bending magnets: the coupling of the transverse planes in the solutions of the equation of motion at second-order, 14:32880 (R;FR)
Study of the e/sup +/e/sup -/ annihilation reaction into four leptons, 14:32634 (R;FR;In French)

Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies
Neutrino oscillations at accelerators. Past results, future prospects, 14:32836 (R;FR)

Paris-7 Univ., 75 (France)
Neutrino oscillations at accelerators. Past results, future prospects, 14:32836 (R;FR)

Parsons (Ralph M.) Co., Charlotte, NC (USA)
Selection of materials for Savannah River Site Consolidated Incinerator Facility (CIF) offgas system, 14:30616 (R;US)
Paul Scherrer Inst. (PSI), Villigen (Switzerland)
Iodine severe accident behaviour code IMPAIR 2, 14:30920 (R;CH)
Pennsylvania State Univ., University Park, PA (USA)
An analysis of soil and surface properties which affect infiltration and runoff on mined lands, Centre County, Pennsylvania, 14:32025 (R;US)
Use of zero and one dimensional RFP models to simulate behavior on ZT-40M and ZT-H: Quarterly progress report, 14:32866 (R;US)
Petro-Canada Products, Sheridan Park, ON (Canada). Research and Development Centre
The degradation study of metals-tolerant fluid catalytic cracking catalyst by molecular probes. Final report, 14:30296 (R;CA)
Petroleum Refinery Research and Development Centre, Plock (Poland)
Corrosion problems in manufacturing liquid fuels in fluidized catalytic (FCC) installations, 14:30295 (R;GB)
Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Sicherstellung und Endlagerung Radioaktiver Abfaelle
Dose rates of waste packagings. A manual for activity determination of single radionuclide mixtures in standardized waste packagings resulting from dose rate limits, 14:30574 (R;DE;In German)
Pickard, Lowe and Garrick, Inc., Newport Beach, CA (USA)
Seismic margin assessment of the Catawba Nuclear Station: Volume 2, Appendixes: Final report, 14:30902 (R;US)
Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering
Dewatering of fine coal refuse: Final report, August 1985–December 1987, 14:30273 (R;US)
Pittsburgh Univ., PA (USA). Dept. of Chemistry
Quantum state resolved desorption of CO from solid surfaces: Progress report, 15 June 1988–14 June 1989, 14:31469 (R;US)
Potomac Electric Power Co., Washington, DC (USA)
Power plant performance monitoring and improvement: Volume 6, Economic dispatch optimization, 14:30794 (R;US)
Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering
Fuels combustion research. Final technical report, 1 October 1985-30 September 1988, 14:31579 (R;US)
Princeton Univ., NJ (USA). Plasma Physics Lab.
Anisotropic distribution function of minority tail ions generated by strong ion-cyclotron resonance heating, 14:32884 (R;US)
Mapping in inertial frames, 14:32837 (R;US)
Measurement of the poloidal magnetic field in the PBX-M tokamak using the motional Stark effect, 14:32882 (R;US)
On the self-consistency of the principle of profile consistency results for sawtoothing tokamak discharges, 14:32881 (R;US)
Propagation of a Gaussian beam in a nonhomogeneous plasma, 14:32885 (R;US)
Quenching of Einstein's A-coefficients by photons, 14:32507 (R;US)
TFTR [Tokamak Fusion Test Reactor] neutral beam injected power measurement, 14:32928 (R;US)
The gBL transport equations, 14:32883 (R;US)
Public Works Canada, Ottawa, ON (Canada)
Air circulation evaluation, 14:31084 (R;CA;In English and French)
Comparative performance of fluorescent iron-core ballasts and electronic ballasts, 14:31076 (R;CA;In English and French)
Electrical systems evaluation, 14:31088 (R;CA;In English and French)
Environmental and energy performance, 14:31078 (R;CA;In English and French)
Equipment and systems evaluation. Energy performance, 14:31083 (R;CA;In English and French)
Functional performance, 14:31079 (R;CA;In English and French)
Global evaluation. Energy performance, 14:31082 (R;CA;In English and French)
Illumination evaluation, 14:31085 (R;CA;In French)
Mechanical controls evaluation, 14:31087 (R;CA;In English and French)
Mechanical systems evaluation, 14:31086 (R;CA;In English and French)
Performance evaluation of 3M Silverflux retrofit reflectors, 14:31077 (R;CA;In English and French)
Pollutant evaluation, 14:31081 (R;CA;In English and French)
Retrofit evaluation. Energy performance, 14:31090 (R;CA;In English and French)
Roofing systems evaluation, 14:31089 (R;CA;In English and French)
Systems and material performance, 14:31080 (R;CA;In English and French)

Q

Quebec Ministere de l'Energie et des Resources, Quebec, PQ (Canada)
Energy: driving force of economic development, 14:30977 (R;CA)
Recycling of secondary fibers by the Quebec paper industry, 14:31128 (R;CA;In French)
Quebec Ministere de l'Environnement, Ste-Foy, PQ (Canada)
Recycling of iron and steel. State of the situation, 14:31152 (R;CA;In French)

R

Radian Corp., Austin, TX (USA)
Prevention reference manual; chemical specific. Volume 13. Control of accidental releases of methyl isocyanate. Final report, June 1987-September 1988, 14:31945 (R;US)
Strategy for developing environmental sampling and analysis programs at coal-gasification pilot and demonstration plants. Topical report, 14:30266 (R;US)
Radievyj Inst., Leningrad (USSR)
Mathematical modelling of extraction dynamics in differential-contact extractor, 14:31576 (R;SU;In Russian)
Rancho Los Amigos Medical Center, Downey, CA (USA)
Supercomputers for solving PDE problems. Final report, 1 October 1985-31 March 1988, 14:32980 (R;US)
Ranger Uranium Mines Proprietary Ltd., Chatswood (Australia)
Application of best practicable technology to water management at Ranger Uranium mine: report of the technical working group, 14:30623 (R;AU)
RCG/Hagler, Bailly, Inc., Washington, DC (USA)
Report of the Office of Energy. Project evaluation and implementation, 14:30993 (R;US)
Rensselaer Polytechnic Inst., Troy, NY (USA)
Verification analysis of the toroidal accelerator rotor platform wind energy conversion system. Summary report, 14:30789 (R;US)
Rensselaer Polytechnic Inst., Troy, NY (USA). Rensselaer Color Measurement Lab.
Research on tandem solar cells. Volume 1. Final report. Volume 2. Appendices. Report for 15 May 1984-1 August 1985, 14:30707 (R;US)
Research Triangle Inst., Research Triangle Park, NC (USA)
Annual report on performance-audit results for POHC (Principal Organic Hazardous Constituents) testing during RCRA trial burns, 14:31989 (R;US)
Development and validation of a test method for acrylonitrile emissions, 14:31951 (R;US)
Multicycle testing of zinc ferrite, 14:30250 (R;US)
Quality-assurance audits of the EPA (Environmental Protection Agency) state-operated precipitation-collection network: 1987, 14:31950 (R;US)
Resource Development Associates, Inc., Dayton, OH (USA)
Buffalo district heating and cooling system: technical and economic assessment. Final report, 14:31150 (R;US)
Rochester district-heating-system reconfiguration: technical and economic feasibility. Final report, 14:31151 (R;US)
Rijksinstituut voor Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands)
Dutch priority programme on acidification: Summary report, Acidification research, 1984–1988, 14:31969 (R;NL)

Rio Grande do Norte Univ., Natal (Brazil)
Pre-cambrian geochronology in Rio Grande do Norte, Brazil, 14:32416 (R;BR;In Portuguese)
Risoe National Lab., Roskilde (Denmark)
Analysis of low-pressure gas-phase pyrolytic reactions by mass spectrometric techniques, 14:31582 (R;DK)
Environmental aspects. Development of a computer model for environmental impact of energy production, 14:32002 (R;DK;In Danish)
Impressions of the Japanese Sunshine and Moonlight projects, 14:30989 (R;DK)
Irradiation data for bump tests 1-11: Risoe Fission Gas Project: Revision, 14:30871 (R;DK)
Low-temperature heat storage at Risoe. Pilot project, 14:30960 (R;DK;In Danish)
Project WIND, phase IV, dispersion study. Aerial smoke plume observations and surface layer turbulence measurements. Part 1, 14:31909 (R;DK)
Puncturing results and plenum spectrometry on IFA 148 pins and bump tests 1-11: Risoe Fission Gas Project, 14:30872 (R;DK)
RIT Research Corp., Rochester, NY (USA)
Case-Hoyt/Rochester Corporation printing waste heat recovery project. Final report, 14:31125 (R;US)
Rochester Gas and Electric Corp., NY (USA)
Field evaluation of high-efficiency gas furnaces. Final report, 14:30323 (R;US)
Rochester Univ., NY (USA). Dept. of Chemistry
Transition metal activation and functionalization of carbon-hydrogen bonds: Progress report, December 1, 1988–November 30, 1989, 14:31466 (R;US)
Rockwell International Corp., Golden, CO (USA)
Effects of multiple reductions on grain refinement during hot working of alloy 718, 14:31225 (R;US)
Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant
The hot deformation behavior of an as-cast alloy 718 ingot, 14:31226 (R;US)
Rogalandsforskning, Stavanger (Norway)
Position controllable working platform in derricks, 14:31689 (R;NO;In Norwegian)
Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)
Radon generation, adsorption, absorption, and transport in porous media, 14:31062 (R;US)
Royal Inst. of Tech., Stockholm (Sweden)
Behavior of a corium jet in high pressure melt ejection from a reactor pressure vessel, 14:30841 (R;SE)
Rupprecht and Patashnick Co., Inc., Voorheesville, NY (USA)
TEOM(trade mark) real-time carbon-concentration monitor. Final report, 14:30809 (R;US)
Rutherford Appleton Lab., Chilton (UK)
Anisotropy and energy dependence of the differential neutron scattering cross-section in vanadium, 14:32753 (R;GB)
Auroral electron accelerator. Manifestation of a universal ion/wave/electron interaction, 14:32479 (R;GB)
Fundamentally new physics at the Tevatron Collider?, 14:32592 (R;GB)
High energy magnetic inelastic neutron scattering at ISIS, 14:32752 (R;GB)
Performance of prototype position-sensitive neutron detectors on SXD at ISIS, 14:31850 (R;GB)

S

S-Cubed, San Diego, CA (USA)
MULTEQ: Equilibrium of an electrolytic solution with vapor-liquid partitioning and precipitation: Volume 1: User's manual, Revision 1, 14:30838 (R;US)
Sandia National Labs., Albuquerque, NM (USA)
16th inter-ram conference for the electric power industry, 14:30752 (R;US)
3D thermal stress analysis of WIPP room T RH TRU experiments, 14:30584 (R;US)
A 1-D, hard x-ray pinhole camera for flash x-ray pulsed-power accelerators, 14:31869 (R;US)
A fiber optic test system for quantum efficiency measurements, 14:31875 (R;US)
A method for evaluating structural transducers used in Type B package testing, 14:30592 (R;US)
A novel TR [transmit/receive] switch utilizing a distributed amplifier, 14:31870 (R;US)
A one-dimensional scintillator camera for the SATURN x-ray simulation accelerator, 14:31851 (R;US)
A preliminary assessment of the effect of sunshape on the performance of central receiver systems, 14:30751 (R;US)
A review of near field seawater-sediment interactions with application to the subseabed disposal of nuclear waste, 14:30578 (R;US)
A source term methodology for spent fuel cask containment evaluations, 14:31606 (R;US)
Acoustic emissions during anelastic strain recovery of cores from deep boreholes, 14:32434 (R;US)
Advanced handling technology project and implications for cask design, 14:30595 (R;US)
Alternatives for implementing burnup credit in the design and operation of spent fuel transport casks, 14:31605 (R;US)
An analysis of severe air transport accidents, 14:30597 (R;US)
An analysis of the background and development of regulations for the air transport of plutonium in the USA, 14:30596 (R;US)
An analysis of the consequences of accidents involving shipments of multiple Type A radioactive material (RAM) packages, 14:30594 (R;US)
An estimate of the contribution of spent fuel products to the releasable source term in spent fuel transport casks, 14:30586 (R;US)
An SCR-switched, high voltage, high gain linear transformer system, 14:31674 (R;US)
Analysis of a probe-metallic sleeve feed system for a rectangular waveguide, 14:31615 (R;US)
Application of a mixture theory model to the dispersal of solid by a high-pressure gas, 14:31896 (R;US)
Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 14:30582 (R;US)
Basic Energy Sciences Materials Sciences programs: FWP executive summaries, 14:31228 (R;US)
Ceramic joining in the United States, 14:31287 (R;US)
Characteristics of select glass tube preconcentrators used with an ion mobility spectrometer, 14:31871 (R;US)
Characterization of booster-rocket propellants and their simulants, 14:31895 (R;US)
Closing photoconductive semiconductor switches, 14:31673 (R;US)
Comparison of analysis methods for burnup credit applications, 14:30588 (R;US)
Computed and measured responses of a thick-walled hollow cylinder of salt subjected to both homogeneous and inhomogeneous loading, 14:30585 (R;US)
Coupling of the boundary element method with an integral momentum boundary-layer technique to calculate forces and moments on three-dimensional bodies, 14:31603 (R;US)
Demonstration of a Time Projection Compton Spectrometer, 14:31872 (R;US)
Department of Energy trip report: Review of the US photovoltaics industry conducted in November and December 1988, 14:30709 (R;US)
Design aspects of plutonium air-transportable packages, 14:30600 (R;US)
Design basis for resistance to shock and vibration, 14:30599 (R;US)
Design verification testing, 14:30591 (R;US)
Detection of very high energy γ-rays from the Crab nebula, 14:32462 (R;US)
Did high-altitude EMP [electromagnetic pulse] cause the Hawaiian streetlight incident?, 14:31903 (R;US)
Direct phase estimation from phase differences using fast elliptic PDE [partial differential equation] solvers, 14:31607 (R;US)
Documentation for users: Audience, content, and language, 14:33023 (R;US)

Dynamic fracture toughness measurements of ferritic ductile cast iron, 14:31604 (R;US)
Dynamics and static behavior of metal gussets in cask impact limiters, 14:31613 (R;US)
Evaluation of waveform digitizer systems and components in accordance with IEEE waveform digitizer standards, 14:31676 (R;US)
Experiments in rock mechanics for the site characterization of Yucca Mountain, 14:30583 (R;US)
Feasibility study for a periodic downhole seismic source, 14:31609 (R;US)
Fiber optic sensing in a high explosives environment, 14:31874 (R;US)
Fission reactor pumped lasers: History and prospects, 14:31632 (R;US)
Force and moment reconstruction for a nuclear transportation cask using sum of weighted accelerations and deconvolution theory, 14:30602 (R;US)
Gamma-ray emission probabilities of the daughters of ^{238}U, 14:32692 (R;US)
Heat transfer in severe accident simulations, 14:30601 (R;US)
Imagine: A TACS [Test Analysis Computing System] interactive imaging system, 14:33010 (R;US)
Impact testing and analysis for structural code benchmarking, 14:31612 (R;US)
In-service analysis of cask contamination weeping, 14:31610 (R;US)
Islanding in dispersed, utility-interactive photovoltaic systems, 14:30749 (R;US)
Issues in shock-induced solid state chemistry, 14:31475 (R;US)
Issues pertinent to sealing of radioactive waste repositories in bedded salt formations, 14:30603 (R;US)
Local isotropic/global orthotropic finite element technique for modeling the crush of wood in impact limiters, 14:31614 (R;US)
Low-Level Waste Ocean Disposal Program final report: Site characterization of the Pacific Study Area, West Coast, Northern Site (W-N), 14:30577 (R;US)
Micropyrolyzer design for infrared spectroscopy applications, 14:31336 (R;US)
Modeling thermal-mechanical processes associated with the initiation and combustion of granular energetic materials, 14:31583 (R;US)
Numerical simulations of RADLAC, IBEX, Recirc, and PT0 in 1988, 14:31767 (R;US)
OGR [Office of Geologic Repositories] repository-specific rod consolidation study: Effect on costs, schedules, and operations at the Yucca Mountain repository, 14:30576 (R;US)
Oil velocities in the Weeks Island mine during oil recycle exercises, 14:30285 (R;US)
Oxidation of MoS_2 by thermal and hyperthermal atomic oxygen, 14:31331 (R;US)
Performance of the Hermes-III gamma ray simulator, 14:32930 (R;US)
Performance of the Hermes-III laser-triggered gas switches, 14:32931 (R;US)
Performance of the Hermes-III pulse forming lines, 14:31701 (R;US)
Photoconductive semiconductor switch (PCSS) recovery, 14:31672 (R;US)
Preliminary plan for disposal-system characterization and long-term performance evaluation of the Waste Isolation Pilot Plant, 14:30590 (R;US)
Prepositioned shared secret and/or shared control schemes, 14:33022 (R;US)
Proceedings of the annual solar thermal technology research and development conference, 14:30753 (R;US)
PVREG - A photovoltaic voltage regulation investigation tool: Program reference manual, 14:30748 (R;US)
PVREG – a photovoltaic voltage regulation investigation tool: PVREG user's manual, 14:30747 (R;US)
Pyramidal horns: Part 1: Simple expressions for directivity as a function of aperture phase error, 14:31867 (R;US)
Pyramidal horns: Part 2, A novel design method for horns of any desired gain and aperture phase error, 14:31868 (R;US)
Real gas equations of state for CHEMKIN, 14:31335 (R;US)
Relevance of partial saturation to the mechanical behavior of tuffs, 14:30581 (R;US)
Resistive Contrast Imaging applied to multilevel interconnection failure analysis, 14:31675 (R;US)
Results of pressurized-slot measurements in the G-Tunnel underground facility, 14:30589 (R;US)
Sandia's UGT Instrumentation Development Program: INWET'89 Paper No. 15, 14:31876 (R;US)
Standard thermal problem set, 14:31611 (R;US)
Standardized piezoelectric polymer (PVDF) gauge for detonator response measurement, 14:31892 (R;US)
System-based component test plans and operating characteristics: Introduction and overview, 14:33009 (R;US)
Technical issues affecting the transport of dual purpose casks, 14:30580 (R;US)
The delineation of the disturbed rock zone surrounding excavations in salt, 14:30579 (R;US)
The development of a mobile instrumentation data acquisition system for use in cask testing, 14:30593 (R;US)
The effects of snow on landmarks in K_u band SAR [Synthetic Aperture Radar] images, 14:31866 (R;US)
The PVDF [polarized polyvinylidene fluoride polymer film] piezoelectric polymer shock-stress sensor: Signal conditioning and analysis for field test application, 14:31865 (R;US)
The risks and consequences from the transport of low specific activity materials by truck, 14:30451 (R;US)
The Saturn x-ray framing camera, 14:31873 (R;US)
The solidification metallurgy of Alloy 718 and other Nb-containing superalloys, 14:31227 (R;US)
The use of a thermal probe to determine the effective thermal conductivity of packaging contents, 14:30587 (R;US)
Thermal analyses of a generic rail cask model and thermal response of a test article using different high temperature boundary conditions, 14:30598 (R;US)
Thermophysical properties of advanced carbon materials for Tokamak limiters, 14:32929 (R;US)
Two-dimensional phase correction of synthetic aperture radar imagery, 14:31608 (R;US)
Two-phase flow measurements by nuclear magnetic resonance imaging, 14:31657 (R;US)
Vacuum arc remelting of Alloy 718, 14:31229 (R;US)
Validation of core debris/concrete interactions and source term models, 14:30921 (R;US)
Z-pinch modeling at Sandia National Laboratories, 14:31631 (R;US)

Sandia National Labs., Livermore, CA (USA)
Coal Combustion Science quarterly progress report, October–December 1988, 14:30282 (R;US)
Guide for preparing Safe Operating Procedures (SOPs), 14:30983 (R;US)

Sao Paulo Univ., SP (Brazil). Inst. Astronomico e Geofisico
Magmatic and petrologic evolution of the mesozvic vulcanic acid rocks from Piraju-Ourinhos region (SP-PR), 14:32414 (R;BR;In Portuguese)

Sao Paulo Univ., SP (Brazil). Inst. de Geociencias
Radiogeologic reconnaissance in Perus region, Sao Paulo, Brazil, 14:31991 (R;BR;In Portuguese)

Saskatchewan Justice, Regina, SK (Canada)
Report on the terms of reference respecting the inquiry into certain aspects of the Surface Rights Acquisition and Compensation Act, and the board of arbitration for the province of Saskatchewan, 14:30307 (R;CA)

Saskatchewan Univ., Saskatoon, SK (Canada). Dept. of Electrical Engineering
Farm losses resulting from electric service interruption, 14:31132 (R;CA)

Savannah River Lab., Aiken, SC (USA)
Application of Lotus 1-2-3 to heat transfer analysis, 14:31654 (R;US)
PC-based calculation of activation energy using linear regression, 14:30900 (R;US)

Science and Engineering Research Council, Swindon (UK)
Corporate plan 1989, 14:32970 (R;GB)
Ground based plan. A plan for research in astronomy and planetary science by ground based techniques, 14:32454 (R;GB)

Science Applications International Corp., Lexington, MA (USA)
Assessment of a novel r-f linac amplifier concept. Final report, June 1987-July 1988, 14:31711 (R;US)

Science Applications International Corp., McLean, VA (USA)
Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988, 14:30800 (R;US)
Ensuring effective monitoring technology for arms control verification: Final report, 14:31172 (R;US)

SCS Engineers, Inc., Covington, KY (USA)
Trace constituents in landfill gas. Task report on corrosion potential. Final report, May 1984-June 1985, 14:30652 (R;US)

Seaconsult Marine Research Ltd., Vancouver, BC (Canada)
Evaluation of wave forecasting models and forecast wind fields in the Canadian context, 14:32440 (R;CA)

Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway)
Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)
New method for the cleaning of drilling mud, 14:31690 (R;NO;In Norwegian)
New methods for the covering of the energy demand of agriculture. Mobile electric operation, 14:31131 (R;NO;In Norwegian)

Severn Communications Corp., Millersville, MD (USA)
Astronaut radiation exposure in low-earth orbit. Part 1. Galactic cosmic radiation, 14:32366 (R;US)
Contributions to the plenary meeting of cospar (Committee on Space Research) (27th) held in Helsinki, Finland 18-29 July 1988, 14:32365 (R;US)
Equations of cosmic-ray transport with distributed acceleration, 14:32443 (R;US)

Shawinigan Consultants, Inc., Montreal, PQ (Canada)
Electicity supply voltage problems, 14:30817 (R;CA)

Sherbrooke Research Centre, PQ (Canada)
Sixteenth progress report contract to develop an asbestos cement (A/C) cooling tower fill for thermal generating plants. Report no. 23, 14:31665 (R;CA)

Siemens A.G., Erlangen (Germany, F.R.)
PWR steam generator tube fretting and fatigue wear: Final report, 14:30839 (R;US)

Simons (H.A.) Ltd., Vancouver, BC (Canada)
Steam substitution in chemical process, petrochemical and petroleum industries, 14:31130 (R;CA)

Sinor (J.E.) Consultants, Inc., Niwot, CO (USA)
Industrial market assessment of the products of mild gasification: Final report, 14:30251 (R;US)

Smithsonian Astrophysical Observatory, Cambridge, MA (USA)
The application of two-dimensional imaging to very high energy gamma ray astronomy: Progress report, 14:32444 (R;US)

Sociedade Brasileira de Cancerologia, Salvador, BA (Brazil)
Proceedings of the 2. Iberian-American Congress of Oncology, 14:32212 (R;BR;In Portuguese)

Solar Energy Research Inst., Golden, CO (USA)
Biofuels program summary: Volume 1, Overview fiscal year 1988, 14:30702 (R;US)
Biofuels Program summary: Volume 2, Research summaries, fiscal year 1988, 14:30703 (R;US)
Department of Energy trip report: Review of the US photovoltaics industry conducted in November and December 1988, 14:30709 (R;US)
Development of a second-generation, video-based luminance mapper for daylighting research, 14:31091 (R;US)
Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems, 14:30758 (R;US)
Focusing on the future: Solar thermal energy systems emerge as competitive technologies with major economic potential, 14:30700 (R;US)
Photovoltaic Program Branch annual report, FY 1988, 14:30708 (R;US)
Programs in energy conservation: Industrial programs, 14:31109 (R;US)
SERI results from the PEP 1987 Summit Round Robin and a comparison of photovoltaic calibration methods, 14:30738 (R;US)
Testing of novel desiccant materials and dehumidifier matrices for desiccant cooling applications, 14:31092 (R;US)
Wind Energy Program Summary: Volume 2: Research summaries, fiscal year 1988, 14:30784 (R;US)

South Carolina Univ., Columbia, SC (USA). Dept. of Biological Sciences
The effects of atmospheric CO_2 on insect herbivores and their hosts plants: Progress report, 14:31924 (R;US)

South Carolina Wildlife and Marine Resources Dept., Columbia, SC (USA)
Wildlife management assistance report: Progress report, July 1, 1988–June 30, 1989, 14:32027 (R;US)

Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility
LEP and CEBAF polarimeters: Revision, 14:31734 (R;US)

Southern Electric International, Atlanta, GA (USA)
PVREG – a photovoltaic voltage regulation investigation tool: PVREG user's manual, 14:30747 (R;US)

Southern Illinois Univ., Carbondale, IL (USA)
Metallic glasses as selective catalysts for synthesis of hydrocarbon liquids in high sulfur conditions: Final report, January 1–December 31, 1988, 14:30650 (R;US)

Southern Illinois Univ., Carbondale, IL (USA). Coal Extraction and Utilization Research Center
High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, January 1–March 31, 1989, 14:30240 (R;US)

Southwest Research Inst., San Antonio, TX (USA)
Characterization of mechanical damage mechanisms in ceramic composite materials. Technical report, 23 May 1987-24 May 1988, 14:31314 (R;US)
Characterization of pore evolution in ceramics during creep failure and densification, 14:31277 (R;US)

SRI International, Menlo Park, CA (USA)
Electrochemical oxidation of methane at metal and oxide electrodes. Annual report, December 1, 1987-December 1, 1988, 14:31046 (R;US)
Study of ammonia removal in coal gasification processes: Final report, 14:30249 (R;US)

SRI International, Menlo Park, CA (USA). Center for Occupational and Environmental Safety and Health
Occupational safety and health effects of high-voltage transmission lines, 14:32405 (R;US)

Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)
Advice on the disposal of radioactive by-products arising in the use of nuclear energy, 14:30575 (R;DD;In German)
Calibration and intercomparison of neutron moderation spectrometers, 14:32777 (R;DD)
External occupational radiation exposure in the GDR in 1987, 14:32778 (R;DD;In German)
Recommendations for the determination of migration parameters by field experiments (tracer tests), 14:30885 (R;DD;In German)

Stanford Linear Accelerator Center, Menlo Park, CA (USA)
A calorimeter software trigger for the Mark II detector at SLC [Stanford Linear Collider], 14:31853 (R;US)
A formalism and computer program for coupled lattices, 14:31793 (R;US)
A new switched power linac structure, 14:31705 (R;US)
A search for close-mass lepton doublet, 14:32548 (R;US)
Accelerator diagnosis and control by Neural Nets, 14:31703 (R;US)
Analytic estimates of coupling in damping rings, 14:31794 (R;US)
Annual environmental monitoring report, January–December 1988, 14:31702 (R;US)
Anomalous electron loading in SLAC 5045 klystron and relativistic klystron input cavities, 14:31774 (R;US)
Beam dumps, stoppers and Faraday cups at the SLC, 14:31781 (R;US)
Beam dynamics with the Hamilton-Jacobi equation, 14:31728 (R;US)
Beam-based alignment technique for the SLC [Stanford Linear Collider] linac, 14:31776 (R;US)
Bunch lengthening calculations for the SLC [Stanford Linear Collider] damping rings, 14:31791 (R;US)

Construction of symplectic full-turn maps by application of an arbitrary tracking code, 14:31727 (R;US)
Damped accelerator structures for future linear $e^{\pm}$ colliders, 14:31772 (R;US)
Design calculations and measurements of a dipole magnet with Permendur pole pieces, 14:31775 (R;US)
Dynamics of an electron in an rf gap, 14:31725 (R;US)
High-yield positron systems for linear colliders, 14:31769 (R;US)
Long ion chamber systems for the SLC [Stanford Linear Collider], 14:31779 (R;US)
Magnets for high energy colliders, 14:31770 (R;US)
Momentum slits, collimators and masks in the SLC, 14:31780 (R;US)
Particle identification using dE/dx in the Mark II detector at the SLC, 14:31854 (R;US)
Precision measurements of the SLC [Stanford Linear Collider] beam energy, 14:31778 (R;US)
Precision synchrotron radiation detectors, 14:31777 (R;US)
Recent results on S = −3 baryon spectroscopy from the LASS [Large Aperture Superconducting Solenoid] spectrometer, 14:32549 (R;US)
Relativistic klystrons, 14:31771 (R;US)
Report on the international workshop on next generation linear colliders, 14:31706 (R;US)
Rf breakdown studies in copper electron linac structures, 14:31773 (R;US)
Rollfix—An adiabatic roll transition for the SLC [Stanford Linear Collider] Arcs, 14:31723 (R;US)
Study of straw chamber lifetime with argon ethane, 14:31852 (R;US)
The optical design of the spin manipulation system for the SLAC Linear Collider, 14:31726 (R;US)
The Stanford Linear Collider, fall 1988, 14:31704 (R;US)
Timing and rf synchronization for filling PEP/SPEAR with the SLC Damping Rings, 14:31792 (R;US)
Transient analysis of multicavity klystrons, 14:31768 (R;US)
Transverse and longitudinal coupled bunch instabilities in trains of closely spaced bunches, 14:31724 (R;US)
Triggering and data acquisition aspects of SSC tracking, 14:31855 (R;US)

Stanford Univ., CA (USA). Dept. of Computer Science
Beta operation: a parallel primitive. Doctoral thesis, 14:32977 (R;US)
QLISP for parallel processors. Final report, 15 July 1986-31 July 1988, 14:32974 (R;US)

Stanford Univ., CA (USA). W.W. Hansen Labs. of Physics
Efficient second harmonic conversion of broadband high-peak-power Nd:glass laser radiation using large-aperture KDP crystals in quadrature, 14:32926 (R;US)
Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988, 14:31266 (R;US)

Stanley Associates Engineering Ltd., Yellowknife, NT (Canada)
Sewage waste discharge to the arctic marine environment, 14:32047 (R;CA)

State Univ. of New York, Binghamton, NY (USA). Dept. of Chemistry
Bimetallic promotion of cooperative hydrogen transfer and heteroatom removal in coal liquefaction: Quarterly technical progress report, December 1, 1988–February 28, 1989, 14:30263 (R;US)

Statens Energiverk, Stockholm (Sweden)
Bark gasification at Vaeroe bruk, 14:30742 (R;SE;In Swedish)
Electric power market report 1988, 14:31034 (R;SE;In Swedish)
Energy forest east. Progress report 1987-1988, 14:30740 (R;SE;In Swedish)
Energy forest south. Progress report 1987-1988, 14:30739 (R;SE;In Swedish)
Environmental measurements at the Korsta CFB-boiler, 14:30801 (R;SE;In Swedish)
Gas composition of the freeboard gas in a fluidized bed boiler., 14:31584 (R;SE;In Swedish)
IEA R and D Wind Energy. Annual report 1988, 14:30785 (R;SE)
Optimization of the total efficiency of district heating production., 14:31153 (R;SE;In Swedish)
Quantification of micro organisms in biofuels - a quick analytical method, 14:31395 (R;SE;In Swedish)
Spectral measurement SMHI. Final report, 14:31877 (R;SE;In Swedish)
Task report: Stockholm no 1564/881110. Technique - Fuel preparation, 14:30675 (R;SE;In Swedish)
Testing station at Soesdala. Experiments concerning energy forest on organogenic soil (exploited peatland), 14:30741 (R;SE;In Swedish)

Stearns Catalytic Ltd., Sernia, ON (Canada)
Chemical heat pump study. Final report., 14:31129 (R;CA)

Stieff Research and Development Co., Inc., Kensington, MD (USA)
Development of electret technology to measure indoor radon-daughter concentrations: Final report (Phase 1), 14:31064 (R;US)

Stockholm Univ. (Sweden)
Psychological aspects of nuclear waste disposal: Long time perception and the question of discounting of risks, 14:30606 (R;SE)
Time orientation, planning horizons and responsibility into the future, 14:30605 (R;SE)

Stone and Webster Engineering Corp., Boston, MA (USA)
Proceedings: 1986 workshop on advanced high-strength materials, 14:30821 (R;US)

Strasbourg-1 Univ., 67 (France)
Contribution to the determination of nuclear friction by studying the de-excitation of nuclei in the transient regime, 14:32698 (R;FR;In French)
Design and develpment of photoelectron detection chambers for the DELPHI experiment RICH Cerenkov counters, 14:31809 (R;FR;In French)
Particle evaporation-fission competition in nuclear fission considered as a diffusion process, 14:32697 (R;FR;In French)
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)

Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires
C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels, 14:32655 (R;FR)
Contribution to the determination of nuclear friction by studying the de-excitation of nuclei in the transient regime, 14:32698 (R;FR;In French)
Design and develpment of photoelectron detection chambers for the DELPHI experiment RICH Cerenkov counters, 14:31809 (R;FR;In French)
Giant dipole resonances in hot nuclear matter in the model of self-relaxing mean-field, 14:32707 (R;DE)
Monopole and quadrupole vibrations of a hot nucleus, 14:32705 (R;DE)
Particle evaporation-fission competition in nuclear fission considered as a diffusion process, 14:32697 (R;FR;In French)
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)

Structural Integrity Associates, San Jose, CA (USA)
Microbial corrosion: 1988 workshop proceedings, 14:30865 (R;US)

Studsvik Energiteknik AB, Nykoeping (Sweden)
Base irradiation history report of ASEA-ATOM fuel rods for the Super-Ramp Extension Project, 14:30827 (R;SE)
Ceramography of AA test fuel rods OA1-1, OA1-2 and OL1-4: The Super-Ramp Extension Project, 14:30873 (R;SE)
Fabrication and characterization of ASEA-ATOM fuel rods for the Super-Ramp Extension Project: The Super-Ramp Extension Project, 14:30826 (R;SE)
Fabrication, pre-irradiation characterization and base-irradiation data of test fuel rod group PK1X: The Super-Ramp Extenstion Project, 14:30843 (R;SE)

Hot cell interim examination of OII stringer rod OA1: The Super-Ramp Extension Project, 14:30828 (R;SE)
Power ramp irradiation of AA test fuel rods OA1-1,-2,-3,-4 and OL1-1, -4: The Super-Ramp Extension Project, 14:30830 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1984–February 28, 1985, 14:30831 (R;SE)
The Studsvik Super-Ramp Extension Project: Ceramography of Asea Atom test fuel rod OL1-1, 14:30832 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, March 1, 1985–September 30, 1985, 14:30833 (R;SE)
The Studsvik Super-Ramp Extension Project: Power ramp irradiation of test fuel rod group PK1X, 14:30844 (R;SE)
The Studsvik Super-Ramp Extension Project: Non destructive examinations of the PK1X rod and the rod OL1-5, 14:30834 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1985–March 31, 1986, 14:30835 (R;SE)
The Studsvik Super-Ramp Extension Project: Destructive post-irradiation examinations of rod group PK 1X, 14:30836 (R;SE)
The Studsvik Super-Ramp Extension Project: Complementary post-irradiation examinations of KWU/CE rods at Karlstein, 14:30829 (R;SE)

Studsvik Nuclear, Nykoeping (Sweden)
Determination of radioactive emission origins based on analyses of isotopic composition, 14:31987 (R;SE;In Swedish)

Stuttgart Univ. (Germany, F.R.). Fakultaet 13 - Verfahrenstechnik
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)

Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme
Attempts at modelling the processes of gas- and water-atomization for the production of metal powders, 14:31198 (R;DE;In German)

Surface Rights Board, Edmonton, AB (Canada)
Surface rights board, sixteenth annual report, 14:31002 (R;CA)

Surface Rights Board, MB (Canada)
Manitoba surface rights board annual report, 1987-88, 14:30308 (R;CA)

Swedish Council for Building Research, Stockholm (Sweden)
Cold district heating from a quarry at Kaageroed. Evaluation of an experimental building project, 14:31135 (R;SE;In Swedish)

Swedish Environmental Research Inst., Goeteborg (Sweden)
Emission of carbon dioxide from anthropogenic sources in Sweden, 14:31926 (R;SE;In Swedish)
PRENOX tests at recovery boiler 70 at Norrsundets Bruk. A study of NO/sub x/ emission in sodium nitrate additions, 14:31113 (R;SE;In Swedish)

Swedish Environmental Research Inst., Stockholm
Farming of rainbow trout in acidified waters. Environmental effects and production prospects, 14:32359 (R;SE;In Swedish)
Recovery processes in marine ecosystems, 14:32397 (R;SE)

Swedish Inst. of Space Physics, Kiruna (Sweden)
SPECTRUM - a computer algorithm to derive the flux-energy spectrum of precipitating particles from EISCAT electron density profiles, 14:32478 (R;SE)

Swedish National Board for Technical Development, Stockholm (Sweden)
Heat pump - a technical system in progress, 14:31616 (R;SE;In Swedish)
Test program for electric vehicles and a follow-up of Swedish activities in this area, 14:31162 (R;SE;In Swedish)

Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden)
Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass, 14:30604 (R;SE)
Modelling uranium solubilities in aqueous solutions: Validation of a thermodynamic data base for the EQ3/6 geochemical codes, 14:31577 (R;SE)
Rock sealing - interim report on the rock seealing project (stage 1), 14:30608 (R;SE)
Site characterization and validation. Borehole radar investigations, Stage 1, 14:30609 (R;SE)
Source parameters of major earthquakes near Kiruna, Northern Sweden, deduced from synthetic seismogram computation, 14:32421 (R;SE)

Swedish Nuclear Power Inspectorate, Stockholm (Sweden)
Determination of radioactive emission origins based on analyses of isotopic composition, 14:31987 (R;SE;In Swedish)

Swedish State Power Board, Aelvkarleby (Sweden)
Influence of convection on the temperature distribution and heat losses of solar collectors, 14:30759 (R;SE;In Swedish)

Swedish State Power Board, Vaellingby (Sweden)
Behavior of a corium jet in high pressure melt ejection from a reactor pressure vessel, 14:30841 (R;SE)

Swedish Univ. of Agricultural Sciences, Lund. Dept. of Farm Buildings
Light reduction regarding to the greenhouse construction. Average transmission factor for direct light through the greenhouse roof, 14:30755 (R;SE;In Swedish)

Synergic Resources Corp., Bala-Cynwyd, PA (USA)
Demand-side management strategies for the 90s: Proceedings: Fourth national conference on utility DSM programs: Volume 1, 14:31007 (R;US)

Syracuse Univ., NY (USA)
Methane from partially digested sewage sludge. Final report, 14:30651 (R;US)

Syracuse Univ., NY (USA). Dept. of Geology
Development of gas-bearing reservoirs in the Trenton Llimestone Formation of New York. Final report, 14:30316 (R;US)

T

Taylor (S.R.) and Associates, Bartlesville, OK (USA)
Barrierless ultrasonic air cleaner. Final report, 14:31913 (R;US)

Technische Hochschule Aachen (Germany, F.R.)
Detector system for two-dimensional, position-sensitive detection of neutrons and gamma quanta, 14:31816 (R;DE;In German)
Verification of constitutive equations for application at 850/sup 0/C, using the internal stress concept, 14:31214 (R;DE;In German)

Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen
Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)

Technische Hochschule Aachen (Germany, F.R.). Medizinische Fakultaet
Comparison of various methods relating to radionuclide examination of the thyroid gland, 14:32345 (R;DE;In German)

Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik
Gross properties of nuclei and nuclear excitations. Proceedings, 14:32722 (R;DE)

TECOGEN, Inc., Waltham, MA (USA)
Open cycle heat pump development for local resource use Phase II district heating case study analysis: Progress report, 1 January 1989–30 March 1989, 14:31137 (R;US)

Teknologisk Inst., Taastrup (Denmark). Afd. for Varme-og Installationsteknik
Experimental investigation of regulating systems for combinations of solar collectors and heat pumps, 14:30750 (R;DK;In Danish)

Teknologisk Inst., Taastrup (Denmark). Bioteknik
Use of hemicellulose hydrolate in the production of fatty acids, 14:32175 (R;DK;In Danish)

Teknologisk Inst., Tastrup (Denmark)
Low temperature heating in existing buildings, 14:31143 (R;DK;In Danish)

Tennessee Univ., Knoxville, TN (USA)
Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)

Tennessee Univ., Tullahoma, TN (USA). Space Inst.
Magnetohydrodynamics Coal-Fired Flow Facility: Quarterly technical progress report, October–December 1988, 14:31041 (R;US)

Tetra Tech, Inc., Lafayette, CA (USA)
Chemical data for predictinng the fate of organic compounds in water: Volume 1, Technical basis: Final report, 14:32035 (R;US)

Texas Univ., Austin, TX (USA). Bureau of Economic Geology
Bureau of Economic Geology annual report, 1988, 14:30278 (R;US)

Texas Univ., Austin, TX (USA). Inst. for Fusion Studies
Equilibrium of a plasma in the fluid- and Vlasov-Maxwell systems, 14:32867 (R;US)
Influence of attractive interaction between deuterons in Pd on nuclear fusion, 14:32703 (R;US)

TransAlta Utilities Corp., Calgary, AB (Canada)
Determining geotechnical and hydrogeological parameters using downhole geophysics in the Canadian plains. Phase 1 report. A review of potential applications, vol. 1, 14:32422 (R;CA)

Transport Canada, Ottawa, ON (Canada). Marine Casualty Investigations
Report of investigation surrounding the cirumstances in which the Canadian oil tanker "L'Orme No.1" heavily struck the Ultramar wharf and the ensuing fire, in Quebec harbour on February 1,1988, 14:30309 (R;CA;In English and Frech)

Transportation Energy Management Program, Downsview, ON (Canada)
Evaluation of compressed natural gas conversion systems, 14:31166 (R;CA)

Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii I Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke I Tekhnike, Moscow (USSR)
Methods and programs for numerical solution of the mathematical physics problems. Scientific-technical collection, 14:32824 (R;SU;In Russian)

Turbo-Technics Service, Inc., Toronto, ON (Canada)
Steam turbine off-frequency operation, 14:30802 (R;CA)

U

UKAEA Harwell Lab. (UK). Environmental and Medical Science Div.
Methods for detection of fused alumina powder, used as a tracer aerosol, on air sample filters, 14:31587 (R;GB)

UKAEA Harwell Lab. (UK). Materials Development Div.
Operating instructions for the collection and analysis of x-ray diffraction data using a position sensitive detector system, 14:32782 (R;GB)
Study of defect centres in irradiated optical fibre glasses by electron spin resonance spectroscopy, 14:31315 (R;GB)

UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div.
Photofission assay of 500 litre drums of cemented intermediate level waste. Experimental measurements, 14:31382 (R;GB)

UKAEA Harwell Lab. (UK). Theoretical Physics Div.
Modelling of MOSFET inversion layer conductivity using the resistor network method, 14:31861 (R;GB)

UKAEA Headquarters, London (UK)
Nuclear power and the greenhouse effect. UKAEA memorandum to the House of Commons Select Committee on Energy, 14:30855 (R;GB)

UKAEA Safety and Reliability Directorate, Culcheth (UK)
Transport accident frequency data, their sources and their application in risk assessment, 14:30452 (R;GB)

UNC Geotech, Grand Junction, CO (USA)
Evaluation of the performance characteristics of radon and radon-daughter concentration measurement devices under controlled environmental conditions, 14:30705 (R;US)
Field method for determining thorium-230 in soils, 14:30627 (R;US)
Validation of the diffusion-barrier charcoal canister method, 14:31063 (R;US)

Underground Injection Practices Council, Oklahoma City, OK (USA)
The California Division of Oil and Gas underground injection control program: A peer review, 14:30286 (R;US)

Union Carbide Corp., Tonawanda, NY (USA). Linde Div.
Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report, 14:31164 (R;US)

United Kingdom Nirex, Ltd., Harwell (UK)
Guide to PICKER - a data selection program for the geochemical code PHREEQE, 14:32071 (R;GB)
Progress in the assessment of the corrosion of low and intermediate level waste containers under repository conditions, 14:31218 (R;GB)

Universidade Estadual de Campinas, SP (Brazil). Inst. de Fisica
Contribution to the study of zinc and cadmium diffusions in InP and In/sub 0,97/ Ga/sub 0,03/ As/sub 0,08/ P/sub 0,92/ quaternary compound, 14:31199 (R;BR;In Portuguese)

Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia
Cold forming degree and heat treatment on Wste 26 dished head, 14:30868 (R;BR)
Ductile crack growth in nuclear austenitic stainless steel plates: influence of crack orientation and steel microstructure, 14:31205 (R;BR)
Dynamic fracture behavior of nodular cast iron, 14:31206 (R;BR)
Fatigue life prediction for a cold worked T316 stainless steel, 14:31201 (R;BR)
Hydrogen induced surface effects on the mechanical properties of type 304 stainless steel, 14:31202 (R;BR)
Integrity of austenitic stainless steel piping welds for nuclear service, 14:30869 (R;BR)
Iodine stress corrosion cracking in Zircaloy, 14:31204 (R;BR)
Provisions and active measures to preclude guillotine breaks in piping systems of pressurized water reactors, 14:30905 (R;BR)
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)

Universities Research Reactor, Risley (UK)
Micro-organisms and nuclear waste: a neglected problem, 14:30563 (R;GB)

University of Southern California, Los Angeles, CA (USA)
Microbial screening test for lignite degradation: Final report, 14:30260 (R;US)

Unocal Corp., Parachute, CO (USA). Energy Mining Div.
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. First quarter 1988. Report for 1 January-31 March 1988, 14:30422 (R;US)
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. Second quarter 1988. Report for 1 April-30 June 1988, 14:30423 (R;US)
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report, third quarter, 1988. Report for 1 July-30 September 1988, 14:30424 (R;US)
UNOCAL Parachute Creek Shale Oil Project. Monitoring review committee meeting report. Annual meeting, 1987-1988, 14:30425 (R;US)

UOP, Inc., Des Plaines, IL (USA)
Bench-scale co-processing: Quarterly report No. 2, July 1, 1988–September 30, 1988, 14:30261 (R;US)

USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (USA). Photovoltaic Energy Technology Div.
Department of Energy trip report: Review of the US photovoltaics industry conducted in November and December 1988, 14:30709 (R;US)

USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA)
Technical safety appraisal of the Hanford Tank Farm Facility, 14:30526 (R;US)
Technical safety appraisal of the strategic petroleum reserve, West Hackberry/Big Hill/New Orleans, 14:30299 (R;US)

USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Office of Safety Appraisals
Technical Safety Appraisal of the Sandia reactors, ACRR [Annular Core Research Reactor], SPR III [Sandia Pulse Reactor III], Sandia National Laboratories, Albuquerque, 14:30899 (R;US)

USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Oil, Gas and Shale Technology
Contracts for field projects and supporting research on enhanced oil recovery: Progress review No. 55, quarter ending June 30, 1988, 14:30288 (R;US)

USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of the Deputy Assistant Secretary for Oil, Gas, Shale and Special Technologies
MHD [magnetohydrodynamics] Program Plan, FY 1989, 14:31042 (R;US)

USDOE Assistant Secretary for Management and Administration, Washington, DC (USA). Procurement and Assistance Management
Annual procurement and financial report, FY 1988, 14:32967 (R;US)

USDOE Bartlesville Project Office, OK (USA)
Contracts for field projects and supporting research on enhanced oil recovery: Progress review No. 55, quarter ending June 30, 1988, 14:30288 (R;US)

USDOE Bonneville Power Administration, Portland, OR (USA)
The role of electricity in Pacific Northwest irrigated agriculture: Volume 2, Background materials and support documents: Sections A–C, 14:31107 (R;US)

USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife
Kokanee stock status and contribution Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho: Annual progress report FY 1988, 14:30679 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels
Historical plant cost and annual production expenses for selected electric plants 1987, 14:30792 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Energy Markets and End Use
Financial aspects of the consolidation of the US oil and gas industry in the 1980's, 14:30300 (R;US)
Short-term energy outlook: Quarterly projections, April 1989, 14:30995 (R;US)

USDOE Office of Civilian Radioactive Waste Management, Washington, DC (USA)
Office Automation Plan, 14:30535 (R;US)

USDOE Office of Energy Research, Washington, DC (USA). Office of Health and Environmental Research
Biological assessment of occupational exposure to actinides: Programme; Book of Abstracts, 14:32368 (R;FR)
DOE contractors' meeting on chemicals with living systems, 14:32395 (R;US)

USDOE Office of Scientific and Technical Information, Oak Ridge, TN (USA)
Yucca Mountain Project bibliography, July–December 1988: An update: Civilian Radioactive Waste Management Program, 14:30529 (R;US)

USDOE Radiological and Environmental Sciences Lab., Idaho Falls, ID (USA)
Guidelines for revegetation of disturbed sites at the Idaho National Engineering Laboratory, 14:30622 (R;US)

USDOE Western Area Power Administration, Golden, CO (USA). Office of Environmental Affairs
Annual site environmental report for calendar year 1988, 14:30805 (R;US)

Utah Univ., Salt Lake City, UT (USA). Dept. of Mechanical Engineering
Yaw dynamics of horizontal axis wind turbines: Second annual report, 14:30790 (R;US)

V

Van Hattum en Blankevoort, Beverwijk (Netherlands)
Location-independent study concerning the construction, operation and closure of possible facilities for the final storage of radioactive waste in rock-salt formations in the Netherlands. Executed by Van Hattum and Blankevoort asked for by the Netherlands Energy Research Foundation and subsidized by the Ministry of Economic Affairs, 14:30564 (R;NL;In Dutch)

Versar, Inc., Columbia, MD (USA)
Contribution of atmospheric nitrate deposition to nitrate loading in the Chesapeake Bay. Final report, 14:32045 (R;US)

Voorhees Coll., Denmark, SC (USA)
Development of critical life stage assays: Teratogenic effects of ash basin effluent components on freshwater fish, gambusia affinis and daphnia: Progress report, 21 May 1988–1 June 1989, 14:30275 (R;US)

Vortek Industries Ltd., Vancouver, BC (Canada)
Radiant heating potential of Vortek arc lamps, 14:31133 (R;CA)

Vrije Univ., Amsterdam (Netherlands)
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)

W

Welding Inst. of Canada, Oakville, ON (Canada)
Viscosity effects in selected flux cored arc welding consumables, 14:31338 (R;CA)
Weld overlay disbonding, 14:31232 (R;CA)

Western Research Inst., Laramie, WY (USA)
Acid mine drainage potential of raw, retorted, and combusted Eastern oil shale: Final report, 14:30420 (R;US)
Eastern oil shale conversion using the ROPE [Recycle Oil Pyrolysis and Extraction] process, 14:30370 (R;US)
Heats of dissolution of tar sand bitumen in various solvents, 14:30392 (R;US)
The numerical simulation of forward combustion in a tube reactor using the Sunnyside resource, 14:30369 (R;US)
Three-phase relative permeability of Asphalt Ridge tar sand, 14:30391 (R;US)

Westinghouse Electric Corp., Orlando, FL (USA). Power Systems Div.
Advanced coal-fueled gas turbine systems, Volume 2: Annual technical progress report, 14:30793 (R;US)

Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.
Metallurgical evaluation of FMPC Vessel No. 2, 14:30426 (R;US)

Westinghouse Hanford Co., Richland, WA (USA)
Encapsulated cesium and strontium preliminary description of waste form and canister, 14:30615 (R;US)
Fast Flux Test Facility Passive Safety flow transient test, 14:30926 (R;US)
Hanford site waste management units report: Volume 1, 14:30530 (R;US)
Hanford site waste management units report: Volume 2, 14:30531 (R;US)
Tank farm surveillance and waste status summary report for March 1989, 14:30614 (R;US)

Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center
Metallurgical evaluation of FMPC Vessel No. 2, 14:30426 (R;US)

Westinghouse Savannah River Co., Aiken, SC (USA)
Selection of materials for Savannah River Site Consolidated Incinerator Facility (CIF) offgas system, 14:30616 (R;US)

Wisconsin Univ., Madison, WI (USA)
Liquid helium fluid dynamics studies, 14:31596 (R;US)
The role of proteolytic enzymes in degradation of plant tissues: Summary report, 14:30704 (R;US)

Wisconsin Univ., Madison, WI (USA). Center for Mathematical Sciences
Small internal waves in two-fluid systems. Technical summary report, 14:31651 (R;US)

Wisconsin Univ., Madison, WI (USA). Dept. of Botany
The role of transit peptides in the localization of chloroplastic proteins: Progress report, 14:32172 (R;US)

Wisconsin Univ., Madison, WI (USA). Dept. of Chemical Engineering
Experimental and kinetic modeling of acid/base and redox reaction over oxide catalysts: Annual report, 14:31276 (R;US)

Wisconsin Univ., Madison, WI (USA). Engine Research Center
Analysis and in-cylinder measurement of particulate radiant emissions and temperature in a direct-injection diesel engine, 14:31156 (R;US)
Heat-transfer predictions and experiments in a motored engine, 14:31155 (R;US)

Wisconsin Univ., Madison, WI (USA). Torsatron/Stellarator Lab.
Torsatron/stellarator research at the University of Wisconsin-Madison, 1983, 14:32903 (R;US)

Woodward Clyde Consultants, Santa Ana, CA (USA)
Seismic margin assessment of the Catawba Nuclear Station: Volume 2, Appendixes: Final report, 14:30902 (R;US)

Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet
Cerebral tumours in adults. A review of results achieved with radiotherapy, 14:32346 (R;DE;In German)

Personal Author Index

Authors' surnames are indexed in the form appearing in the publication cited; given names generally have been reduced to initials. For documents with multiple authors, each author name is indexed. The entry for a primary author (first author listed on an abstracted document) includes the full document title and citation number. Entries for other authors provide a cross-reference to the primary author. Also included is information on the document type, country of publication, and the document language listed in parentheses in the format (J;FR;In French and English). Accent marks are not input because of computer alphabetization. Spelling and transliteration follow standard conventions.

A

A CRIEPI, NAGRA, SKB col, *See* Jercinovic, M.J., 14:30604

Abasaeed, A.E., Effect of non-uniform temperature distribution on acid hydrolysis of Aspen hemicellulose, 14:30728 (RA;US)

Abdu, M.A., *See* Muralikrishna, P., 14:31799

Abe, K., Determination of $\sin^2\theta_W$ from measurements of differential cross sections for muon-neutrino and -antineutrino scattering by electrons, 14:32569 (J;US)

Abe, N., *See* Matsubara, T., 14:30864

Abecasis, M.M., Bone marrow transplantation at Inst. Port. Oncologia - Lisbon (Portugal), 14:32217 (RA;BR;In Portuguese)

Abell, D.L., Laboratory for Energy-Related Health Research: Annual report, fiscal year 1987, 14:32394 (R;US)

Abernathey, R.M., *See* Callis, E.L., 14:31473

Abraham, M. M., *See* Gonzalez, R., 14:31366

Abraham, Z., Performance of the 13.7 m Itapetinga radiotelescope, 14:31796 (RA;BR)

Abrahamson, P., Strategic planning framework for technology evaluation, 14:31022 (RA;US)

Abramof, E., *See* Ferreira, S.O., 14:31668

Abrams, G., *See* Klein, S. R., 14:32574

Abyhammar, T., *See* Eriksson, A., 14:30935

Achari, A., Facing up to membranes: structure/function relationships in phospholipases, 14:32122 (BA;US)

Ache, H.J., *See* Dick, R., 14:31392

Achuthan, P.V., Simultaneous estimation of Pu and fission products by gamma spectrometry, 14:31383 (R;IN)

Ackerhalt, J.R., *See* Band, Y.B., 14:31639

Ackerman, J.L., Nuclear magnetic resonance imaging for quality control in the production of advanced ceramic components, 14:31863 (R;US)

See Ellingson, W.A., 14:31272

Acton, M.D., Report on the terms of reference respecting the inquiry into certain aspects of the Surface Rights Acquisition and Compensation Act, and the board of arbitration for the province of Saskatchewan, 14:30307 (R;CA)

Acton, R.U., *See* Moya, J.L., 14:30587

Adair, N.K., *See* Dunkerton, L.V., 14:31487

Adam, C., Recommendations for the determination of migration parameters by field experiments (tracer tests), 14:30885 (R;DD;In German)

Adam, G., *See* Bohndorf, K., 14:32316

Adamo, J.R., *See* Berry, M.T., 14:31519

Adams, J., The challenge of change for Fortran, 14:33013 (R;US)

Adams, M. R., *See* Yoshida, T., 14:32579

Adiga, R., *See* Feng, X., 14:30522

See Macedo, P.B., 14:30510

Adlakha, A., *See* Robinson, W.A., 14:32218

Adler, J., *See* Mir, R., 14:31852

Adler, S.L., *See* Wilczek, F., 14:32543

Adolphsen, C.E., Beam-based alignment technique for the SLC [Stanford Linear Collider] linac, 14:31776 (R;US)

Aegerter, M.A., *See* Santos, D.I. dos, 14:32748

Afanasiev, V.L., Spiral-vortex structure of flat galaxies (prediction, theory, laboratory and numerical experiments, observations), 14:32455 (RA;CS)

Agrawal, D.P., Architectural considerations, software support, and compiler issues in multi-computer implementation. Final report, 5 September 1985-31 October 1988, 14:32976 (R;US)

Agrawal, R.C., Geologic considerations for urban planning in seismic environment, 14:32420 (R;XA)

Ahmed, S.A., *See* Stackhouse, T., 14:32131

Ahrens, L. A., *See* Abe, K., 14:32569

Akerlof, C., Detection of very high energy γ-rays from the Crab nebula, 14:32462 (R;US)

Al-Ghawas, H.A., Modeling the simultaneous transport of two acid gases in tertiary amines with reversible reactions, 14:31423 (J;US)

Aladim, S.R., Quantization of position dependent hamiltonians in the Feynman path integral formalism, 14:32823 (RA;BR)

Alak, A.M., Silver-coated fumed silica as a substrate material for surface-enhanced raman scattering, 14:31409 (J;US)

Alavi, A., *See* Wei, R.P., 14:31243

Alber, T.C., Crystallography and site-directed mutagenesis of yeast triosephosphate isomerase: what can we learn about catalysis from a simple enzyme?, 14:32139 (BA;US)

Albeverio, S., Euclidean quantum mechanics: Analytical approach, 14:32838 (R;DE)

Albinson, J.S., *See* Bode, M.F., 14:32447

Albornoz G, M.P., *See* Alegria R, E., 14:32756

Albrecht, R., Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)

Aldape, F., Analysis of aerosol samples from local atmosphere in Mexico City, 14:31906 (RA;BR)

Aldrich, W.C., *See* Larson, M.M., 14:30544

Alegria R, E., Environmental radioactivity in Chile - during 1987 - Technical information, 14:32756 (R;CL;In Spanish)

Alesso, H.P., Criticality benchmarks for COG: A new point-wise Monte Carlo code, 14:32754 (R;US)

Alexander, J.A., Performance of the Hermes-III pulse forming lines, 14:31701 (R;US)

See Denison, G.J., 14:32931

See Ramirez, J.J., 14:32930

Alexander, J.H., MULTEQ: Equilibrium of an electrolytic solution with vapor-liquid partitioning and precipitation: Volume 1: User's manual, Revision 1, 14:30838 (R;US)

Alexander, M., *See* Prater, G.S., 14:31099

Alexandratos, S.P., Novel bifunctional resins in metal ion separations: ion exchange/coordination resins and ion exchange/precipitation resins, 14:31445 (J;US)

Alexiev, D., Lithium compensation of GaAs, 14:31177 (R;AU)

Alfaro, J., Schwinger-Dyson equations as supersymmetric Ward identities, 14:32619 (R;DK)

Alferov, V.N., Control system of magnetic optical element power supplies for some beam channels, 14:31741 (R;SU;In Russian)

Alfredson, P.G., Status of oil shale developments and supporting research in Australia, 14:30324 (RA;CN)

Alladio, F., Lower hybrid heating in high density discharge in FT, 14:32868 (RA;IT)

Allander, K.S., *See* MacArthur, D.W., 14:31823

Allemann, R.K., *See* Benner, S.A., 14:32084

Allen, B.M., Jr., *See* Perry, R.E., 14:30536

Allen, C.R., *See* Gurley, R.N., 14:30499

Allen, G.C., Design aspects of plutonium air-transportable packages, 14:30600 (R;US)

Allen, J. W., *See* Kang, J., 14:31265
Allen, K., *See* Stygar, W.A., 14:31873
Allen, M.A., Relativistic klystrons, 14:31771 (R;US)
Allen, R.D., Impact of water quality on aquifer thermal energy storage, 14:30943 (RA;CA;In English and French)
Almassy, R.J., *See* Eisenberg, D., 14:32125
Almassy, Z., Dose assessment through micronuclei in irradiated human lymphocytes, 14:32384 (RA;AT)
Almeida, L.H. de., *See* Monteiro, S.N., 14:31203
Almuti, A.M., *See* Ng, C.K., 14:30492
Alstroem, P., Characterization of modulated integrate-and-fire systems, 14:32830 (R;DK)
Local hysteresis in relaxation oscillators, 14:32831 (R;DK)
Mode locking in overdamped charge-density-wave systems, 14:31324 (R;DK)
Non-chaotic transition from quasiperiodicity to complete phase-locking, 14:32829 (R;DK)
Altes, J., *See* Wang, T.J., 14:31323
Althaus, B.L., *See* Uncapher, W.L., 14:30593
Althaus, R., *See* Gilbert, W.S., 14:31765
Altman, S., *See* Lawrence, N., 14:32099
Altobelli, S.A., *See* Givler, R.C., 14:31657
Alves, J.L.A., Microscopic models for (Au-Au) and (Pt-Pt) pair complexes in silicon, 14:32790 (RA;BR)
Alves, M.V., *See* Ferreira, J.L., 14:32781
Alvim, A.C.M., *See* Claro, L.H., 14:30874
Amako, K., *See* Abe, K., 14:32569
Amato, M.A., Long-wavelength behaviour of charge-charge structure factor in insulating and metallic ground state of condensed hydrogen under pressure, 14:32803 (R;BR)
Ambjoern, J., SU(2) lattice gauge theory with an external field, 14:32635 (R;DK)
Ambles, A., *See* Vitorovic, D., 14:30376
Ambolet, M., How to minimize wastes, 14:31180 (R;FR;In French)
Ambrosio, A., *See* Salgado, J., 14:30647
Amby, L., Dynamic characteristics of PUR cellular plastic in pre-insulated district heating pipes, 14:31146 (R;DK;In Danish)
Amick, C.J., Small internal waves in two-fluid systems. Technical summary report, 14:31651 (R;US)
Amidei, D., *See* Klein, S. R., 14:32574
Amin, Y.M., Study of the effect of natural radiation damage in crystal using thermoluminescence fission track etching and x-ray diffraction, 14:31322 (RA;BR)
Ammerich, M., *See* Charuau, J., 14:32769
Amorim, P., *See* Ferreira, J.G., 14:32497
Amrane, N., Design and develpment of photoelectron detection chambers for the DELPHI experiment RICH Cerenkov counters, 14:31809 (R;FR;In French)
Amsden, A.A., KIVA-II: A computer program for chemically reactive flows with sprays, 14:31161 (R;US)
Amsler, C., The Crystal Barrel at LEAR, 14:31859 (J;US)
Anaf, J., Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections, 14:32995 (R;BR;In Portuguese)
See Chalhoub, E.S., 14:32994
See Prati, A., 14:30861
and others, *See* Abe, K., 14:32569
See Anjos, J. C., 14:32571, 14:32572
See Aston, D., 14:32551, 14:32558
See Auer, I. P., 14:32575
See Beck, C., 14:32668
See Beise, E. J., 14:32658
See Blessing, S., 14:32559
See Boehnlein, A., 14:32564
See Bortoletto, D., 14:32573
See Cason, N. M., 14:32557
See Chung, S. U., 14:32566
See Hartouni, E. P., 14:32561
See Hearty, C., 14:32577
See Heffner, R. H., 14:31252
See Klein, S. R., 14:32574
See Kuang, Y., 14:32526
See Lanen, J. B. J. M., 14:32660
See Leitch, M. J., 14:32657
See Loong, C., 14:31302
See Naudet, C., 14:32659
See Park, I. H., 14:32570
See Sanford, T. W. L., 14:32888
See Schulz, M., 14:32516
See Tang, C. Y., 14:32525
See Yoshida, T., 14:32579
Anda, E.V., *See* Klausner, J.C., 14:32792
See Montenegro, N.P., 14:32788
Andachi, Y., *See* Osawa, S., 14:32157
Anders, D.E., *See* Dyni, J.R., 14:30383
Andersen, N.B., Low temperature heating in existing buildings, 14:31143 (R;DK;In Danish)
Andersen, R.A., *See* Brennan, J.G., 14:31578
Anderson, A. C., *See* Yang, I., 14:31380
Anderson, A.B., *See* Fierro, C., 14:31540
Anderson, D., Calculation of triton confinement and burn-up in tokamaks, 14:32902 (R;SE)
Anderson, D.C., *See* Brown, K.W., 14:31999
Anderson, J.E., Guidelines for revegetation of disturbed sites at the Idaho National Engineering Laboratory, 14:30622 (R;US)
Anderson, J.L., User guide for the Data Analysis, Retrieval, and Tabulation System (DARTS): A mainframe computer code for generating cross-tabulation reports, 14:30970 (R;US)
Anderson, L.R., *See* Gill, J.T., 14:32954
Anderson, M.A., *See* Gieselmann, M.J., 14:31432
Andersson, B., Defoliation of coniferous trees. Assessments 1984-1987, 14:32401 (R;SE)
Andersson, I., *See* Braenden, C.I., 14:32126
Andersson, L.A., Swedish shale gasification research program, 14:30366 (RA;CN)
Andersson, P., Chernobyl - radioactivity in sludge produced in wastewater treatment plants, 14:30924 (R;SE;In Swedish)
Andrade, A.H.P. de, Iodine stress corrosion cracking in Zircaloy, 14:31204 (R;BR)
Andrasi, A., Measurements for the estimation of the external doses in Hungary from Chernobyl release, 14:32016 (RA;AT)
Measurements on internal contamination in Budapest due to the Chernobyl accident, 14:32019 (RA;AT)
Andre, J., *See* Boulanger, T., 14:32189
Andreani, R., Engineering features, assembly equipment and installation procedures of the FTU machine, 14:32908 (RA;IT)
Andreia, K., *See* Vannucci, A., 14:32872
Andresen, B., *See* Salamon, P., 14:31325
Andresen, J.E., Chaotic noise in superconducting microbridge 4-photon X-band parametric amplifier, 14:32816 (R;DK)
Andriulli, J.B., Measured damping and modulus of composite cylinders, 14:31662 (R;US)
Androsenko, Kh.D., Angular anisotropy of fragments of /sup 235/U fission induced by 0.014-7.15 MeV neutrons, 14:32684 (RA;XA)
Anema, C., *See* Fee, E.J., 14:32028
Angastiniotis, M., *See* Parker, J.C., 14:30974
See Tharp, W.H., 14:30973
Angel, S. M., Near-infrared surface-enhanced Raman spectroscopy. Part I: Copper and gold electrodes, 14:31356 (J;US)
Angerer, G., *See* Jochem, E., 14:30806
Angerhofer, A., Effect of triplet spin dynamics memory in electron-transfer reactions. Fourier transform-electron paramagnetic resonance spectroscopy, 14:31565 (J;US)
Angus, M.J., Equilibrium leach testing of waste forms containing fuel cladding to evaluate their performance in disposal, 14:30463 (RA;US)
Angus, R.O. Jr., Columnar homoconjugation, 14:31482 (J;US)
Anikejchik, A.M., Start-up of the negative ion injector for the meson factory linear accelerator in the Nuclear Research Institute, Academy of Science, USSR, 14:31743 (RA;SU;In Russian)
Anjos, J. C., Observation of $\Sigma_c^0 \rightarrow \Lambda_c^+ \pi^-$ decays, 14:32572 (J;US)
Observation of excited charmed mesons, 14:32571 (J;US)
Anon., Activity report, 14:32650 (R;FR;In French)
Contributions to the 12th. International Cryogenic Engineering Conference. Southampton, 12-15 July 1988, 14:32905 (R;IT)
National Energy Balance - 1980, 14:31037 (R;BR;In Portuguese)
National Energy Balance - 1982, 14:32969 (R;BR;In Portuguese)

Anoussis, J.N., *See* Kollas, J.G., 14:30913
Anstadt, G.P., *See* Kominsky, J.R., 14:31959
Antalik, R., *See* Gmuca, S., 14:32714
Antic, D., Neutron and gamma radiation doses topography around the rb reactor, 14:30916 (RA;AT)
Antonopoulos, A.A., Fusarium strain development and selection for enhancement of ethanol production, 14:30671 (RA;US)
Identification and evaluation of SERI-NF1 fungus for ethanol production from xylose fermentation, 14:30654 (R;US)
Antrim, L.D., *See* Ward, J.A., 14:32046
Antsipov, G.V., Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Anufrienko, V.B., *See* Sal'nikov, O.A., 14:32646
Anufriev, V.A., Measurement of total neutron cross sections for /sup 152/Gd and /sup 153/Gd(T/sub 1/2/=242 days), 14:32675 (RA;SU;In Russian)
Anzick, R., *See* Johnson, D.K., 14:30737
Anzidei, L., Helium cooled ceramic breeder in tube blanket for a Tokamak reactor, 14:32910 (RA;IT)
Apol, A.G., Health-hazard evaluation determination report No. 75-146-254, Custom Furniture and Cabinets, Inc., Post Falls, Idaho, 14:31964 (R;US)
Appel, J. A., *See* Anjos, J. C., 14:32571, 14:32572
Applequist, J., *See* Wroblewski, A.E., 14:31497
Appleton, B.R., Fabrication of isotopic heterostructures and epitaxial thin films by ion beam deposition, 14:31346 (BA;US)
Appleton, P.R., Transport accident frequency data, their sources and their application in risk assessment, 14:30452 (R;GB)
Appoloni, C.R., *See* Oliveira, J.C.M. de, 14:31814
Aprahamian, A., *See* Roy, N., 14:32682
Apte, P., *See* Willi, O., 14:32896
Archer, D.G., *See* Steele, W.V., 14:30310
Archibald, D. D., *See* Angel, S. M., 14:31356
Arendt, P.N., Assessment of higher-temperature superconductors for utility applications: Final report, 14:30811 (R;US)
Ares, M. Jr., *See* Gerbi, S.A., 14:32150
Arey, J., *See* Zielinska, B., 14:31979
Arguello, J.G., 3D thermal stress analysis of WIPP room T RH TRU experiments, 14:30584 (R;US)
Aristone, F., Landau levels of the two-dimensional electron systems in the corbino geometry, 14:32503 (RA;BR)
Ariyasu, J. C., Determination of the onset of spatiotemporal complexity induced by soliton competition in a perturbed sine-Gordon chain, 14:32855 (J;US)
Arko, A.J., Photoemission spectroscopy of single crystal HTSC materials: A Fermi liquid electronic structure, 14:31393 (R;US)
Armbrecht, L., Density-depending time-differential perturbed angular correlation in gas-phase /sup 111/InCl, 14:32665 (R;DE;In German)
Armstrong, N.R., *See* Nebesny, K.W., 14:31464
Arnberg, A.C., *See* Tabak, H.F., 14:32097
Arnett, E.M., Carbonaceous solids as a model for adsorption by dispersion forces, 14:31516 (J;US)
Arnold, J.R., Scientific considerations in the design of the Mars observer gamma-ray spectrometer, 14:32458 (R;US)
See Jeffries, H.E., 14:31939, 14:31940, 14:31941, 14:31942
Arnold, K., *See* Dannhauer, K.H., 14:32268
See Kuang, Y., 14:32526
Arnold, M., *See* Dufrane, K.H., 14:30485
Arnott, Don., Micro-organisms and nuclear waste: a neglected problem, 14:30563 (R;GB)
Arons, J., *See* Max, C.E., 14:32463
Aronson, M. C., Pressure dependence of the superconducting and Neel temperatures in a $La_2CuO_{4+\delta}$ crystal, 14:31305 (J;US)
Aronson, S., Rare K decays and limits on new forces, 14:32581 (R;US)
Aronson, S. H., *See* Abe, K., 14:32569
Arruda, J., *See* Klausner, J.C., 14:32792
Arruda-Neto, J.D.T., Notes on the theory of parallel plate avalanche detectors, 14:31812 (R;US)
Arseneau, A., *See* Daigle, J.-Y., 14:30276
Arteca, G.A., Shape description of conformationally flexible molecules: application to two-dimensional conformational problems, 14:32180 (BA;US)
Arthurs, D.M., Seasonal heating and cooling through aquifer energy storage, 14:30942 (RA;CA;In English and French)
Artru, M.C., *See* Freire Ferrero, R., 14:32452
Arunasalam, V., Mapping in inertial frames, 14:32837 (R;US)
On the self-consistency of the principle of profile consistency results for sawtoothing tokamak discharges, 14:32881 (R;US)
Asano, H., Physical modeling test of joule heated ceramic melter system for high level waste vitrification, 14:30517 (RA;US)
Ashby, C.I.H., Selective photochemical dry etching of III-V compound semiconductors, 14:31344 (BA;US)
Ashley, G.W., *See* Lin, A.I., 14:32137
Ashline, R.C., *See* Hermann, O.W., 14:30569
Ashwood, T.L., Sources and areal distribution of trace metals in recent sediments of Middle Loch, Pearl Harbor (Hawaii), 14:32038 (R;US)
Assmann, H., CT diagnosis of lumbar prolapse of an intervertebral disc, 14:32307 (RA;DD;In German)
See Kachel, R., 14:32333
Assuncao Matos, H. de, Whole-body irradiation at I.P.O.F.G., Lisboa: technic and dosimetry, 14:32216 (RA;BR;In Portuguese)
Aston, D., Recent results on S = −3 baryon spectroscopy from the LASS [Large Aperture Superconducting Solenoid] spectrometer, 14:32549 (R;US)
The spectroscopy of mesons containing strange quarks, 14:32551 (J;US)
The strangeonium spectrum seen in Lass; implications for glueball spectroscopy, 14:32558 (J;US)
Astrelin, V.T., Negative differential resistance of electron diode in magnetic field, 14:31717 (R;SU;In Russian)
Atkins, A.R., *See* Stephenson, L.C., 14:30363
Atkins, J.F., *See* Weiss, R.B., 14:32148
Atkins, W.H., *See* Olsen, D.K., 14:31786
Atkinson, R., *See* Zielinska, B., 14:31979
Attaway, C.R., *See* Rennich, M.J., 14:30525
Attaway, S.W., Dynamics and static behavior of metal gussets in cask impact limiters, 14:31613 (R;US)
Local isotropic/global orthotropic finite element technique for modeling the crush of wood in impact limiters, 14:31614 (R;US)
See Allen, G.C., 14:30600
See Yoshimura, H.R., 14:30602
Atwood, W.B., *See* Adolphsen, C.E., 14:31776
Atzeni, S., 2-D fluid dynamics models for laser driven fusion on IBM 3090 vector multiprocessors, 14:32907 (R;IT)
Atzmueller, C., *See* Reubel, B., 14:32379
Auer, I. P., Observation of structures in the mass range of 2700 to 2900 MeV in the difference between the *pp* total cross sections for pure helicity states, 14:32575 (J;US)
Auerbach, A., *See* Kim, J. H., 14:32818
Aumayr, F., Quenching of Einstein's A-coefficients by photons, 14:32507 (R;US)
Aurand, J.F., Pyramidal horns: Part 1: Simple expressions for directivity as a function of aperture phase error, 14:31867 (R;US)
Pyramidal horns: Part 2, A novel design method for horns of any desired gain and aperture phase error, 14:31868 (R;US)
Ausseur, J.Y., *See* Iris, P., 14:30931
Austin, P.N., *See* McBride, A.F., 14:30571
Avanzini, P.G., *See* Franconi, E., 14:32913
Avetisov, G.M., *See* Buldakov, L.A., 14:30912
Awaji, N., *See* Aston, D., 14:32549, 14:32551, 14:32558
Awes, T.C., *See* Albrecht, R., 14:32706
Axe, J. D., Structural phase transformations and superconductivity in $La_{2-x}Ba_xCuO_4$, 14:31303 (J;US)
Axelsson, C.L., *See* Zimmer, E., 14:31114
Axmann, W. J., *See* McGuire, J. H., 14:32518
Azevedo, H.L.P. de., Influence of radiolytic degradation products from organic phase, 14:31569 (R;BR;In Portuguese)
Influences of the HNO/sub 3/ initial concentration at aqueous phase and the temperature on zirconium extraction, 14:31385 (R;BR;In Portuguese)
Aziz, M. J., *See* Lu, G. Q., 14:31361
Azuma, O., *See* Allen, M.A., 14:31771

B

Babcock, G.T., *See* Debus, R.J., 14:32196
Babich, S.I., *See* Anufriev, V.A., 14:32675
Babu, M., 1.0 Million Btu combustor testing: Test results: Part 2, 14:30803 (R;US)
Bacala, A., *See* Park, I. H., 14:32570
Bach, E.F., Digital radiography today - state of the art, 14:32272 (RA;DD)
Back, L. H., *See* Venkateshan, S. P., 14:31684
Baden, A. R., *See* Klein, S. R., 14:32574
Badgujar, M., *See* Chiang, Shiao-Hung, 14:30273
Badnell, N. R., Dielectronic recombination of P^{5+} and Cl^{7+} in configuration-average, *LS*-coupling, and intermediate-coupling approximations, 14:32527 (J;US)
Bae, J.H., Analysis of cobalt extraction by di-(2-ethylhexyl) phosphoric acid in a continuous flow stirred tank with a laser capillary spectrophotometer, 14:31421 (J;US)
Baehr, W., *See* Kraemer, R., 14:30477
Baer, H., Search for top-quark decays to real *W* bosons at the Fermilab Tevatron collider, 14:32578 (J;US)
Baer, H. W., *See* Leitch, M. J., 14:32657
Baer, M.R., Modeling thermal-mechanical processes associated with the initiation and combustion of granular energetic materials, 14:31583 (R;US)
See Geller, A.S., 14:31896
Baer, T., *See* Cornish, T.J., 14:31533
Baert, A.L., Nuclear magnetic resonance imaging in chronic hemodialysis associated musculoskeletal amyloidosis, 14:32328 (RA;DD)
Baes, C.F. Jr., *See* Chadwick, R.B., 14:31416
Baethge, M., *See* Freitag, J., 14:32256
Baev, P.V., *See* Afanasiev, V.L., 14:32455
Bagger, C., *See* Carlsen, H., 14:30872
See Knudsen, P., 14:30871
Bagnall, C., Metallurgical evaluation of FMPC Vessel No. 2, 14:30426 (R;US)
Bagnato, V.S., *See* Martin, A.G., 14:32487
Baierl, P., NMR imaging of intracranial tumors in children as compared with CT, 14:32239 (RA;DD;In German)
Bailey, C.B., Multicomponent fixed-bed ion exchange: verification of equilibrium coherence theory, 14:31442 (J;US)
Bailly, H., Alternative fuels for the French fast breeder reactors programme, 14:30848 (R;FR)
Bair, A., Ensuring effective monitoring technology for arms control verification: Final report, 14:31172 (R;US)
Baizhong, Z., Analysis of air-conditioning system with chilled-water storage in aquifer, 14:30949 (RA;CA;In English and French)
Bajaj, J.S., *See* Rao, G.S., 14:32184
Bajc, S., *See* Vitorovic, D., 14:30376
Bakac, A., *See* Masarwa, M., 14:31501
Baker, D.E., *See* Ethridge, J.L., 14:32915
Baker, I., The structure and properties of grain boundaries in B2 ordered alloys: Progress report, 14:31193 (R;US)
Baker, J.O., Beta-glucosidase crosslinking for stability and enzyme recycle, 14:30717 (RA;US)
Denaturation behavior of fungal and thermostable-bacterial beta-glucosidases, 14:30716 (RA;US)
See Tatsumoto, K., 14:30715
Baker, N., *See* Lynch, F., 14:32410
Baker, R.S., Development of a ceramic-based waste form to immobilize ICPP HLW, 14:30516 (RA;US)
Bakker, C.G., *See* Schwartz, A.W., 14:32082
Baktash, C., *See* Albrecht, R., 14:32706
Balakov, V.F., Measuring of spectral composition of the pulse SHF generator signals, 14:31744 (RA;SU;In Russian)
Balasubramanian, K., Ten low-lying electronic states of Pd_3, 14:32513 (J;US)
Balchunas, A.T., Separations of compounds of biological and environmental interest by micellar electrokinetic capillary chromatography, 14:31443 (J;US)
Baldo, P. M., *See* Sharma, R. P., 14:31349
Baldwin, G.T., Demonstration of a Time Projection Compton Spectrometer, 14:31872 (R;US)
Baldwin, R.L., *See* Shoemaker, K.R., 14:32116
Baldwin, R.M., *See* Johnson, D.K., 14:30737
Balents, L., *See* Hagelstein, P.L., 14:31634
Ball, F.D., Geology of New Brunswick oil shales, eastern Canada, 14:30330 (RA;CN)
Balladon, P, Ductile crack growth in nuclear austenitic stainless steel plates: influence of crack orientation and steel microstructure, 14:31205 (R;BR)
Ballesteros, C., *See* Gonzalez, R., 14:31366
Balluffi, R.W., *See* Majid, I., 14:32786
Balooch, M., *See* Olander, D.R., 14:31347
Balzer, K., *See* Seibel, R.M., 14:32304
Bambade, P., Observation of beam-beam deflections at the interaction point of the SLAC Linear Collider, 14:31730 (J;US)
Rollfix—An adiabatic roll transition for the SLC [Stanford Linear Collider] Arcs, 14:31723 (R;US)
See Kent, J., 14:31778
Bamberger, C. E., *See* Begun, G. M., 14:31294
Band, Y.B., Short-pulse intracavity Raman laser, 14:31639 (BA;US)
Bandeira, I.N., *See* Ferreira, S.O., 14:31668
Bando, A., The role of regional activity forecasts in projecting emission trends of acid deposition precursors, 14:31918 (R;US)
Bane, K.L.F., Bunch lengthening calculations for the SLC [Stanford Linear Collider] damping rings, 14:31791 (R;US)
Banerjee, S., Evaluation of non-radiological water chemistry at power reactors, 14:30824 (R;US)
Banning, S. A., *See* Dickinson, P. H., 14:31296
Baracat, W., *See* Gartrell, C.F., 14:31891
Barbato, E., *See* Alladio, F., 14:32868
Barchet, W.R., *See* Dana, M.T., 14:31968
Bardi, U., *See* Ross, P.N., 14:31048
Bardotti, G. and others, *See* Alladio, F., 14:32868
Barfod, E.T., *See* Been, M.D., 14:32093
Barger, V., *See* Baer, H., 14:32578
Barhudarov, R.M., *See* Buldakov, L.A., 14:30912
Barkatt, A., *See* Feng, X., 14:30522
See Macedo, P.B., 14:30510
Barkigia, K.M., Crystal and molecular structure of a nickel isobacteriochlorin derived from a chlorophyll, 14:32185 (BA;US)
Barklow, T., *See* Klein, S. R., 14:32574
Barlow, C.R., *See* Strunk, W.D., 14:30448
Barlow, P., *See* Achari, A., 14:32122
Barna, B.A., *See* Smith, J.A., 14:31110
Barnes, C., *See* Lapedes, A., 14:32174
Barnes, G.A., *See* Rej, D.J., 14:32923
Barnett, C., Targeted modifications to the structure of Trichoderma reesei CBHII, 14:30727 (RA;US)
Barone, S.D., Explanations on nomenclature and number of material for steels in accordance with DIN norm - (Deutsch Industrie Norm), 14:31197 (R;BR;In Portuguese)
Barr, G., Flux of atmospheric neutrinos, 14:32471 (J;US)
Barrett, D., *See* Prono, D.S., 14:31707
Barrett, P.R., *See* Rashid, Y.R., 14:30586
Barrier, J.W., *See* Moore, M.R., 14:30660
Barry, B.A., *See* Debus, R.J., 14:32196
Barsanti, M. L., *See* Fliflet, A. W., 14:31889
Bartels, R., Dosis loads for temporary workers in decontamination and radiation protection engaged in West German nuclear power plants, 14:30915 (RA;AT;In German)
Bartha, G., *See* Hearty, C., 14:32577
Bartkiewicz, M., *See* Lawrence, N., 14:32099
Bartlett, P.A., Phosphorus-containing peptide analogs as peptidase inhibitors, 14:32087 (BA;US)
Bartlett, R.J., *See* Arko, A.J., 14:31393
Bartlit, J.R., *See* Casey, M.A., 14:32941
See Sherman, R.H., 14:32963
Basche, S., *See* Kachel, R., 14:32333
Baskes, M.I., Fracture from an atomistic point of view, 14:31342 (BA;US)
Basmaji, P., Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE), 14:32789 (RA;BR)
Bassani, S., *See* Anzidei, L., 14:32910
Bastos, P., *See* Cox, H.M., 14:31231

Bastos, PL., *See* Morais, P.C., 14:31230
Basu, P., *See* Panayotov, D., 14:31529
Basu, R., *See* Sengupta, A., 14:31434
Basu, T.K., Research and development activities of the seismology section for the period January 1986 to December 1987, 14:32418 (R;IN)
Bateman, V., *See* Yoshimura, H.R., 14:30602
Bates, J.K., NNWSI [Nevada Nuclear Waste Storage Investigation] waste form testing at Argonne National Laboratory: Semiannual report, July–December 1987, 14:30611 (R;US)
Bates, M., *See* Alexandratos, S.P., 14:31445
Bates, S.O., Leach testing of simulated Hanford Waste Vitrification Plant reference glass HW-39, 14:30573 (R;US)
Batheja, P., Hydraulic control rod drive for water-cooled nuclear reactors, particularly heating reactors, 14:30825 (TG;US)
Batista, A.R.D., Oil shale industrialization in Brazil, 14:30367 (RA;CN)
Battistoni, G., Tracking techniques in underground physics, 14:31813 (R;IT)
Battistoni, P., *See* Anderson, D., 14:32902
Bau, R., *See* Yuan, H.S.H., 14:32355
Bauer, F., *See* Moore, L.M., 14:31892
Bauer, W.M., *See* Baierl, P., 14:32239
Bauert, H., *See* Puura, V., 14:30331
Baum, J.W., Occupational exposures and practices in nuclear power plants, 14:30895 (R;US)
Baumann, J., *See* Dorfman, R.C., 14:31556
Bautista, R.G., *See* Hu, X., 14:31450
Bayliss, A., Numerical computation of bifurcation phenomena and pattern formation in combustion, 14:31273 (R;US)
Bdzil, J. B., Modeling two-dimensional detonations with detonation shock dynamics, 14:32533 (J;US)
Beale, J.M., Studies on the biosynthesis of the m-C_7N unit in the antibiotics manumycin and asukamycin, 14:31507 (J;US)
Beamesderfer, R.C., MOCPOP: a flexible simulator for analysis of age-structured population and stock-related functions, 14:30697 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part III. Abundance and distribution of northern squawfish, walleye, and smallmouth bass, 14:30686 (RA;US)
Simulation of predation by a resident fish on juvenile salmonids in a Columbia River Reservoir, 14:30690 (RA;US)
Size selectivity and bias in estimates of population parameters of smallmouth bass, walleye, and northern squawfish in a Columbia River reservoir, 14:30695 (RA;US)
User's guide for RESPRED: a model of predation by resident fish on juvenile salmonids in a Columbia River reservoir, 14:30698 (RA;US)
See Rieman, B.E., 14:30687, 14:30688
Bean, A., *See* Anjos, J. C., 14:32571, 14:32572
Beard, R., *See* Muralidhara, H.S., 14:31455
Beauchamp, E.K., Beta alumina failures in sodium/sulfur batteries, 14:30969 (BA;US)
Beauchemin, R., *See* Noiseux, D.U., 14:30812
Beche, M., *See* Pajot, J., 14:30847
Beck, C., Fusion of ^{16}O + ^{40}Ca at $E_{lab}(^{16}O)$=13.4 MeV/nucleon, 14:32668 (J;US)
Beck, J. V., *See* Courville, G. E., 14:31658
Beck, M.J., Comparison of Saccharomyces cerevisiae and Candida shehatae for bioconversion of corn stover hydrolyzate to ethanol, 14:30670 (RA;US)
Fermentability tests of sugars produced in the Solar Energy Research Institute's plug-flow reactor, 14:30658 (RA;US)
Beck, S.R., Integrated process for production of ethanol, 14:30664 (RA;US)
Becker, F.E., *See* DiBella, F., 14:31137
Becker, H., *See* Terwey, B., 14:32300
Becker, J.A., *See* Roy, N., 14:32682
Becker, K., Quo vadis, personnel monitoring?, 14:32772 (RA;AT)
Beckman, W. A., *See* Seem, J. E., 14:31095
Been, M.D., Structures involved in Tetrahymena rRNA self-splicing and RNA enzyme activity, 14:32093 (BA;US)
Begemann-Blaich, M., *See* Wilhelmy, J.B., 14:32681
Beggio, P., *See* Minach, L., 14:32362
Begovich, J.M., *See* Collins, E.D., 14:30459
Begun, G. M., Raman spectroscopic observation of laser-induced oxidation of transition-metal borides, carbides, and nitrides, 14:31294 (J;US)
Behlen, L.S., *See* Sampson, J.R., 14:32103
Behlke, M., *See* Eisenberg, B.M., 14:32335
Beier, E. W., *See* Abe, K., 14:32569
Beiersdorfer, P., High-resolution bent-crystal spectrometer for the ultrasoft x-ray region, 14:32890 (J;US)
Beise, E. J., Measurement of $^{16}O(\gamma,n)^{15}O$ at medium energies, 14:32658 (J;US)
Bekri, O., Oil shale activities in Morocco, 14:30326 (RA;CN)
Bel'chenko, Yu.I., Negative ion production in pure-hydrogen discharges of surface plasma, 14:32918 (R;SU;In Russian)
Negative ion surface-plasma source for plasma trap injectors development in Novosibirsk, 14:32919 (R;SU;In Russian)
On geometric focusing of negative hydrogen ions in surface-plasma sources, 14:31747 (R;SU;In Russian)
Belan, A., *See* Hajek, M., 14:32260
See Lizler, J., 14:32282
Belanger, P.L., Health-hazard evaluation determination report No. 77-44-435, Keller Columbus, Inc., Columbus, Ohio, 14:31948 (R;US)
Beleznay, E., *See* Andrasi, A., 14:32019
Belfort, M., Genetic delineation of functional components of the group I intron in the phage T4 td gene, 14:32204 (BA;US)
Bell, J.B., A second-order projection method for the incompressible Navier Stokes equations on quadrilateral grids, 14:32529 (R;US)
Adaptive mesh refinement on moving quadrilateral grids, 14:32530 (R;US)
Bell, J.T., Fifth symposium on separation science and technology for energy applications, 14:31396 (B;US)
Bell, P.R.F., *See* Zhu, S., 14:30421
Bell, R., Air quality survey in the vicinity of the Petro-Canada Trafalgar Refinery, Oakville, Ontario, 14:30305 (R;CA)
Bellan, P. M., Particle confinement in realistic 3D rotamak equilibria, 14:32892 (J;US)
See Siegrist, K., 14:32937
Bellefeuille, S.M., *See* Causgrove, T.P., 14:31541
Bellet, M., Echography in diagnosis of breast cancer, 14:32215 (RA;BR;In Portuguese)
Bellocq, C., *See* Kolakofsky, D., 14:32114
Bellon, P., Cascade effects in non equilibrium phase transitions with metallurgical relevance, 14:31181 (R;FR)
Bellwied, R., Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Bem, Z., Diagnosis of abdominal lymphomas by CT, 14:32297 (RA;DD;In German)
Ben-Shachar, B., Fading of CaF/sub 2/-Tm (TLD-300), 14:31840 (RA;AT)
Benassai, S., Implementing optimization principle in the design of nuclear power plants: regulatory trends in Italy, 14:30854 (RA;AT)
Benatan, E.J., *See* Peebles, C.L., 14:32098
Bender, C. M., A new perturbative approach to nonlinear problems, 14:32848 (J;US)
Bender, J., *See* Langford, A. A., 14:31679
Benedek, R., *See* Garner, J., 14:32813
Benedict, U., *See* Gerward, L., 14:31326, 14:31328
See Staun Olsen, J., 14:31327, 14:31329
Benhenni, M., *See* Schulz, M., 14:32516
Benjegerdes, R., *See* Gilbert, W.S., 14:31765
Benkovic, S.J., *See* Fierke, C.A., 14:32142
See Tramontano, A., 14:32088
Benmerrouche, M., Problems of describing spin-(3/2 baryon resonances in the effective Lagrangian theory, 14:32603 (J;US)
Benner, S.A., Natural selection, protein engineering, and the last riboorganism: rational model building in biochemistry, 14:32084 (BA;US)
Bennett, P.C., In-service analysis of cask contamination weeping, 14:31610 (R;US)
See Griesmeyer, J.M., 14:30595
Bennhold, C., Relativistic multipole operators for semileptonic weak and electromagnetic nuclear reactions, 14:32602 (J;US)
Bensinger, J. R., *See* Cason, N. M., 14:32557

Bentley, J.C., Information needs for value-based planning, 14:31017 (RA;US)
Beratan, D.N., *See* Onuchic, J.N., 14:31510
Beraun, R., *See* Arguello, J.G., 14:30584
Berezin, F.N., On-line measurement system of multidimensional spectra with real time digital preprocessing of experimental information, 14:31819 (R;SU;In Russian)
Berg, B. A., Correlation length and order of the deconfining phase transition, 14:32604 (J;US)
Berg, J.M., Metal ions in proteins: structural and functional roles, 14:32136 (BA;US)
Bergemann, L., Operation experience with an automatic dosimetry system and digitally indicating dosemeters in the Gundremmingen nuclear power plant block B and C, 14:32773 (RA;AT;In German)
Bergenlid, U., The Studsvik Super-Ramp Extension Project: Non destructive examinations of the PK1X rod and the rod OL1-5, 14:30834 (R;SE)
Berger, B. K., *See* Matsuki, T., 14:32468
Bergeron, P.W., Experimental studies of the progressing batch reactor, 14:30710 (RA;US)
Berghaus, D.G., *See* Woods, T.O., 14:31194
Bergles, A. E., *See* Chyu, M. -C., 14:31660
Berglund, G.R., PREPP [Process Experimental Pilot Plant] rotary kiln plant performance overview, 14:30540 (R;US)
Bergman, C., Land burial facility at the Forsmark plant. Inspection notes, 14:30640 (R;SE;In Swedish)
See Ericsson, G., 14:30641
Bergman, D. J., *See* Marianer, S., 14:31255
Bergman, R., *See* Holden, M.S., 14:31652
Bergman, R.G., *See* McGhee, W.D., 14:31502
See Stoutland, P.O., 14:31525
Bergmann, H., *See* Havlik, E., 14:31847
Berka, R., *See* Barnett, C., 14:30727
Berkeland, D.J., A method for sizing sub-micron particles using small angle diffraction of soft x-rays, 14:32801 (R;US)
Berkowitz, J., *See* Ruscic, B., 14:31479
Berlowitz, P.J., Kinetics of CO oxidation on single-crystal Pd, Pt, and Ir, 14:31515 (J;US)
Bernard, H., *See* Bailly, H., 14:30848
Bernasek, S.L., *See* Norton, A.P., 14:31564
Berndt, L., *See* Rosenkranz, G., 14:32759
Bernholc, J., *See* Salamon, P., 14:31325
Bernstein, D.R., *See* Ronan, M.T., 14:31792
Bernstein, J., Comment on "Reheated Universe by unstable neutrinos", 14:32466 (J;US)
Bernstorff, S., Photoemission from excited states in rare gas solids by combining synchrotronradiation with a laser, 14:31321 (R;DE;In German)
Berry, M.T., Spectroscopic mapping of the OH-Ar van der Waals potential, 14:31519 (J;US)
Berry, R.S., *See* Salamon, P., 14:31325
Berryman, J. G., Fermat's principle and nonlinear traveltime tomography, 14:32852 (J;US)
Bersohn, R., *See* Johnston, G. W., 14:31544
Berthet, J.P., *See* Bertin, M., 14:32771
Bertin, M., Dose assessment and medical consequences of radiation exposure of employees of Electricite de France, 14:32771 (RA;AT)
Bertram-Howery, S.G., Preliminary plan for disposal-system characterization and long-term performance evaluation of the Waste Isolation Pilot Plant, 14:30590 (R;US)
Betak, E., *See* Gmuca, S., 14:32714
Bettinali, L., *See* Migliori, S., 14:32906
Beyer, J., Gastric evacuation in smallmouth bass (Micropterus dolomieui), 14:30683 (RA;US)
Beyer, J.B., *See* Byrnes, S.J., 14:31870
Beyer, J.M., Digestive tract evacuation in northern squawfish (Ptychocheilus oregonensis), 14:30682 (RA;US)
Beyermann, M., Advice on the disposal of radioactive by-products arising in the use of nuclear energy, 14:30575 (R;DD;In German)
Bezdrobnaya, L.K., Induction and reparation of DNA strand breaks at neutron and X-ray irradiation at various stages of cell cycle, 14:32375 (RA;SU;In Russian)
Bhadra, R., *See* Sharma, R. P., 14:31349
Bhalla, C. P., Resonant transfer and excitation in collisions of Li-like F^{6+} and Ca^{17+} with light targets, 14:32523 (J;US)
Bhatia, T.S., *See* Wangler, T.P., 14:31720
Bhattacharya, P., *See* Williams, C. K., 14:31351
Bhattacharyya, K.K., Woodwaste incineration and air quality in Williams Lake, 14:31914 (R;CA)
Bhogale, R.G., *See* Achuthan, P.V., 14:31383
Bhuloka Reddy, S., *See* Sastry, D.L., 14:32498
Biasi, R.S. de, Electron paramagnetic resonance in the orthorhombic and tetragonal phases of YBa/sub 2/Cu/sub 3/O/sub x/, 14:32795 (R;BR;In Portuguese)
Bibler, J.P., Cation resins for Cs and Sr removal in the F/H Effluent Treatment Facility, 14:30537 (R;US)
Bickhardt, J., Possible evaluation of the dignity of pulmonary coin lesions by quantitative CT, 14:32285 (RA;DD;In German)
Biebricher, C.K., Replication and evolution of short-chained RNA species replicated by $Q\beta$ replicase, 14:32106 (BA;US)
Bienkowski, P.R., *See* Gilbert, V.P., 14:31492
Bienz, T., *See* Aston, D., 14:32549, 14:32551, 14:32558
Bierman, M.R., *See* Cline, J.E., 14:30462
Biggiero, V., *See* Carotenuto, A., 14:30937
Biglo, I. J., *See* Scott, A. C., 14:31375
Bigio, I.J., *See* Mukherjee, P., 14:31637
See Shimada, T., 14:31650
Bihl, D.E., *See* Sula, M.J., 14:32392
Billaux, D., *See* Long, J.C.S., 14:32433
Bille, J., *See* Wittler, C., 14:32387
Billinton, R., *See* Wacker, G., 14:31132
Binder, W., *See* Wandl-Hainberger, I., 14:32352
Bingham, C.E., *See* Pesaran, A.A., 14:30758, 14:31092
Binkley, D., *See* Van Miegroet, H., 14:30701
Binning, K.E., Tips for the fabrication of temporary tritium experiments, 14:32947 (J;US)
See Carlson, R.V., 14:32943
Birath, S., Ceramography of AA test fuel rods OA1-1, OA1-2 and OL1-4: The Super-Ramp Extension Project, 14:30873 (R;SE)
Hot cell interim examination of OII stringer rod OA1: The Super-Ramp Extension Project, 14:30828 (R;SE)
Bird, F., *See* Aston, D., 14:32549, 14:32551, 14:32558
Birkhold, U., *See* Loeschhorn, U., 14:30897
Birman, A., *See* Blessing, S., 14:32559
See Boehnlein, A., 14:32564
Birren, B.W., Regulation of the rat metallothionein-I gene by sodium butyrate, 14:32199 (J;GB)
Bischof, C.H., Parallel QR factorization algorithm using local pivoting, 14:32978 (R;US)
Bischof, W., Legal aspects of justification and optimization in radiation protection, 14:30636 (RA;AT;In German)
Bishop, A. R., *See* Ariyasu, J. C., 14:32855
See Gouv@/re@, 14:32811
See Nakamura, K., 14:32858
See Peyrard, M., 14:32207
Bishop, J. M., *See* Cason, N. M., 14:32557
Biswas, N. N., *See* Cason, N. M., 14:32557
Bitelli, U.D., Measurement of the neutron-spectrum in the IEA-R1 research reactor, 14:30889 (RA;BR)
Bittencourt, M.S.Q., *See* Barone, S.D., 14:31197
Bitter, M., *See* Beiersdorfer, P., 14:32890
Bittner, R., Conventional and fast NMR imaging in expanding processes of the thorax, 14:32284 (RA;DD;In German)
See Henkes, H., 14:32336
See Sander, B., 14:32224
Bivered, B., *See* Birath, S., 14:30828
Biwer, B.M., *See* Bates, J.K., 14:30611
Bjerle, I., *See* Andersson, L.A., 14:30366
Bjerre-Nielsen, H., *See* Joens, E., 14:31116
Bjornstad, B.N., 40 CFR 265 interim status indicator-evaluation ground-water monitoring plan for the 216-B-63 trench, 14:32001 (R;US)
Bjurman, B., *See* Finck, R., 14:32007
Blachot, J., *See* Duchemin, B., 14:30856
Blacic, J. D., *See* Rovetta, M. R., 14:30761
Black, D. R., *See* Long, G. G., 14:31890
Black, S., Organosolv pretreatment, 14:30666 (RA;US)

See Chum, H.L., 14:30736
Blacklow, S.C., *See* Hermes, J.D., 14:32138
Blaich, T., *See* Wilhelmy, J.B., 14:32681
Blair, D.S., Micropyrolyzer design for infrared spectroscopy applications, 14:31336 (R;US)
Blair, S.C., Laboratory observations of the effect of geological discontinuities on hydrofracture propagation, 14:32435 (R;US)
Permeability of Ironton-Galesville sandstone at elevated temperature and pressure, 14:30941 (RA;CA;In English and French)
Blake, C.C.F., Exon and domain evolution in the proenzymes of blood coagulation and fibrinolysis, 14:32171 (BA;US)
Blake, J.B., Radiation dose in a Molniya-type orbit. Technical report, 14:32746 (R;US)
Blanc, F., Last improvements of the DTC 1000 spectrophotometer, 14:30437 (R;FR;In French)
Blander, M., *See* Indacochea, J.E., 14:31274, 14:31275
Blankinship, S.L., *See* Scott, C.D., 14:30247
Blann, M., Photon annd pion production in heavy ion collisions, 14:32740 (R;US)
Role of pre-equilibrium theory in nuclear data evaluation, 14:32726 (RA;SU)
Blaschke, U., *See* Heitner, H., 14:32326
Blatt, M., Market assessment for future technologies, 14:31066 (RA;US)
Blau, S. K., Dray–'t Hooft geometries and the death of white holes, 14:32469 (J;US)
Blejwas, T.E., Experiments in rock mechanics for the site characterization of Yucca Mountain, 14:30583 (R;US)
Blesin, H.J., *See* Buchali, K., 14:32265
Blessing, S., Mass dependent fits of the partial wave analysis of the $K^+K0\pi-$ system, 14:32559 (J;US)
Blok, H. P., *See* Lanen, J. B. J. M., 14:32660
Bloom, I., Na- and S-activity measurements using glass-membrane reference electrodes/sensors, 14:31052 (BA;US)
Bloom, S.G., A computer program for simulating the atmospheric dispersion of UF_6 and other reactive gases having positive, neutral, or negative buoyancy, 14:31907 (R;US)
Bloom, T.F., *See* Hills, B., 14:31952
See Zaebst, D.D., 14:31956
Bloomquist, G., Regulatory and commercial aspects, 14:30765 (RA;US)
Blotcky, A.J., Determination of selenium metabolites in biological fluids using instrumental and molecular neutron activation analysis, 14:31459 (J;US)
Blowes, D.W., *See* Palmer, C.D., 14:30956
Blum, L., *See* Kressel, H.Y., 14:32295
Boatner, L. A., *See* Budai, J. D., 14:31311
Boatwright, B., *See* Guram, M.S., 14:30275
Bocarsly, A.B., *See* Norton, A.P., 14:31564
Bock, R., *See* Albrecht, R., 14:32706
Bode, M.F., UV and optical line emission from the shell of the old nova GK Persei, 14:32447 (RA;FR)
Bodwin, G. T., Effects of initial-state QCD interactions in the Drell-Yan process, 14:32644 (J;US)
Boeck, H., Chernobyl accident and its radiological impact for Austria, 14:30917 (RA;AT;In German)
Boeckel, M., *See* Kirsch, H., 14:30630
Boeglin, A., *See* Lin, S.H., 14:31517
Boehnlein, A., Preliminary results of $\bar{p}p$ at 8 GeV/*c*, 14:32564 (J;US)
Boehnlein, D., *See* Boehnlein, A., 14:32564
Boekema, C., *See* Heffner, R. H., 14:31252
See Lichti, R. L., 14:31301
Boeniger, M.F., Industrial-hygiene survey report, P. D. George Company, St. Louis, Missouri, February 22-25, 1988, 14:31954 (R;US)
Industrial-hygiene survey report, Wabash Magnetic Company, Huntington, Indiana, May 24-26, 1988, 14:31955 (R;US)
Boergesson, L., *See* Pusch, R., 14:30608
Boernert, P., *See* Schneider, W., 14:32262
Boettner, R., *See* Eisenberg, B.M., 14:32335
Bogacz, S.A., *See* Harfoush, F.A., 14:31713
Bogaty, J.M., An improved phase-control system for superconducting low-velocity accelerating structures, 14:31692 (R;US)
Bogun, K.R., CT system Tomoscan in clinical diagnostics as experienced in ten-month application, 14:32251 (RA;DD;In German)
Bohndorf, K., NMR imaging of the knee-joint cartilage using 3D volume imaging combined with a fast computer for image processing, 14:32316 (RA;DD;In German)
Boiano, J.M., *See* Crandall, M.S., 14:31957
Boijsen, E., Computed radiography with laser-stimulated luminescence, 14:32324 (RA;DD)
Boileau, Y., Underground heat storage in France. Present stage development and future prospects, 14:30948 (RA;CA;In English and French)
Boisde, G., *See* Perez, J.J., 14:31589
Boisdet, A., Project of thermal storage in deep aquifer (Sarcelles, France). Technical data and economic analysis, 14:30940 (RA;CA;In English and French)
See Menjoz, A., 14:30958
Boisseau, P., Ionization technology, 14:30645 (R;FR;In French)
Radiation disinfestation of stored cereals, 14:30644 (R;FR;In French)
Boissevain, J., *See* Wilhelmy, J.B., 14:32681
Bokhorst, J.J.M., *See* Leigh, J.R., 14:32674
Bokhovko, M.V., *See* Kazahov, L.E., 14:32687
See Kononov, V.N., 14:32686
Boldt, J., Potential for seasonal storage of industrial surplus heat, 14:30939 (RA;CA;In English and French)
Boling, M.E., *See* Streetman, K.D., 14:32999
Bolton, T., *See* Mir, R., 14:31852
Bomans, M., *See* Hoehne, K.H., 14:32320
Bond, V.P., *See* Sondhaus, C.A., 14:32367
Bondar, E., Variations in the composition of steranes and triterpanes in oil shales of different origins and stages of maturity, 14:30373 (RA;CN)
Bonin, K. D., Absolute photoionization cross sections of the Cs $7D_{3/2}$ level measured by use of fluorescence reduction, 14:32520 (J;US)
See Kadar-Kallen, M. A., 14:32517
Bonner, B. E., *See* Chung, S. U., 14:32566
Bonnet-Bidaud, J.M., Ultraviolet emission of accreting magnetic white dwarfs, 14:32448 (RA;FR)
Bonnin, P., *See* Charissoux, C., 14:32784
Booker, B.L.P., Ceramic Technology for Advanced Heat Engines Project data base: September 1988 summary report, 14:31159 (R;US)
Booz, J., *See* Schmitz, T., 14:31845
Bopp, B.W., *See* Shore, S.N., 14:32453
Boratto, F.J.M., Influences of deformation velocity and temperature on localized deformation of zircaloy-4 in tensile tests, 14:31209 (R;BR;In Portuguese)
Borchardt, D., Radiation protection aspects of rebuilding the Berlin research reactor (Ber 2), 14:30893 (RA;AT;In German)
Borchardt, G., *See* Weise, L., 14:30845
Borisch, R.R., Supernatant treatment system at the West Valley Demonstration Project, 14:30460 (RA;US)
Borisenko, O.A., Deconfinement analysis in exactly solvable model of lattice QCD in strong coupling approximation, 14:32631 (R;SU)
Borison, A., Value of product differentiation in electricity markets, 14:31024 (RA;US)
Borman, G.L., *See* Yan, J., 14:31156
Borns, D.J., The delineation of the disturbed rock zone surrounding excavations in salt, 14:30579 (R;US)
Bornt, F.W., Application of Lotus 1-2-3 to heat transfer analysis, 14:31654 (R;US)
PC-based calculation of activation energy using linear regression, 14:30900 (R;US)
Bornyakov, V.G., *See* Ambjoern, J., 14:32635
Borree, R.J., *See* Wilson, S.W., 14:31624
Borrego, J.M., Research on tandem solar cells. Volume 1. Final report. Volume 2. Appendices. Report for 15 May 1984-1 August 1985, 14:30707 (R;US)
Bortoletto, D., Search for $b \rightarrow u$ transitions in exclusive hadronic *B*-meson decays, 14:32573 (J;US)
Bos, A.J.J., Relative sensitivity of thermoluminescent materials to 15MeV neutrons. New experimental data with respect to the

shape of the glow curve and influence of the encapsulating material, 14:31841 (RA;AT)
See Vries, W. de, 14:31833
Boschetti, C., *See* Ferreira, S.O., 14:31668
Bostroem, C.Aa., PRENOX tests at recovery boiler 70 at Norrsundets Bruk. A study of NO/sub x/ emission in sodium nitrate additions, 14:31113 (R;SE;In Swedish)
Boswell, D.R., *See* Carrell, R.W., 14:32130
Bouchard, R., *See* Vosikovsky, O., 14:31196
Boudart, M., *See* Davis, R. J., 14:31304
Boulanger, T., 3- and 5-isoxazolol zwitterions: a model of interaction with the GABA-A receptor relating to agonism and antagonism, 14:32189 (BA;US)
Bourdon, S., *See* Glass, R.E., 14:31611
Bourgade, J.L., Gain measurements at 5nm in nickel like ytterbium, 14:31179 (R;FR)
Bourgeois, C., *See* Roussiere, B., 14:32669
Bowen, W.R., *See* Turner, A.D., 14:30458
Bower, W., Evaluation of stand-alone inverters for remote applications, 14:30818 (BA;US)
Bowers, D. L., *See* Huff, E. A., 14:31242
Bowlen, K.L., Development and field test of a desiccant-based air conditioning system for supermarkets. Final report, October 1983-May 1988, 14:31073 (R;US)
Bowles, C.R., Start-up experience and operations of an incinerator and super-compactor, 14:30489 (RA;US)
Bowles, E., *See* Prono, D.S., 14:31707
Bowles, E.C., Kokanee stock status and contribution Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho: Annual progress report FY 1988, 14:30679 (R;US)
Bowman, D.R., *See* Moretto, L.B., 14:32670
Bowman, M.K., *See* Angerhofer, A., 14:31565
Bowser, *See* Wieneke, R.E., 14:32935
Boxberger, L.M., ANL site response for the DOE FY1991 information technology resources long-range plan, 14:32981 (R;US)
Boyarski, A., Particle identification using dE/dx in the Mark II detector at the SLC, 14:31854 (R;US)
Boyarski, A. M., *See* Klein, S. R., 14:32574
Boyce, J. B., *See* Bridges, F., 14:31308
Boyer, J., *See* Klein, S. R., 14:32574
Boyer, K., *See* Cullen, D., 14:31626
Boyle, R.J., *See* Rickelton, W.A., 14:31412
Boynton, W.V., *See* Arnold, J.R., 14:32458
Braathen, G., Time-resolved reaction of $O_2(^1\Delta)$ with I^- in aqueous solution, 14:31537 (J;US)
Bracker, S. B., *See* Anjos, J. C., 14:32571, 14:32572
Bradley, D.R., *See* Powers, D.A., 14:30921
Bradley, M.J., *See* Bowles, C.R., 14:30489
Bradley, W.L., Dynamic fracture behavior of nodular cast iron, 14:31206 (R;BR)
Bradshaw, J.S., *See* Izatt, R.M., 14:31439
Bradshaw, W.M., Pilot-scale testing of a fuel oil-explosives cofiring process for recovering energy from waste explosives: Final report, 14:31901 (R;US)
Brady, K.T., *See* Dunkerton, L.V., 14:31487
Brady, M.C., Comparison of analysis methods for burnup credit applications, 14:30588 (R;US)
Braenden, C.I., Structural and evolutionary aspects of the key enzymes in photorespiration; RuBisCO and glycolate oxidase, 14:32126 (BA;US)
Braeutigam, K.R., Analysis of dispersion and deposition of acidifying and phytotoxic air pollutants, 14:31928 (R;DE;In German)
Braga, J., *See* Villela, T., 14:31797
Bramble, J. H., Incomplete iterations in multistep backward difference methods for parabolic problems with smooth and nonsmooth data, 14:33016 (J;US)
Brand, F.J.F. van den., Two-body electrodisintegration of /sup 4/He studied through the (e,e'X) reaction, 14:32652 (R;NL)
Brandl, V., *See* Braeutigam, K.R., 14:31928
Braun, M.A., Production of light fragments in hA collisions at high energies, 14:32710 (R;XA)
Brelt, A., Three-dimensional representation in neuroradiology, 14:32323 (RA;DD;In German)
Brennan, A., Dilute acid hydrolysis of high solids woods slurries in a two-stage continuous flow process, 14:30657 (RA;US)
Brennan, J.G., Crystal structures of $(MeC_5H_4)_4U_2(\mu\text{-}NR)_2$. Unsymmetrical bridging, R = Ph, and symmetrical bridging, R = $SiMe_3$, organoimide ligands in organoactinide compounds, 14:31578 (J;US)
Breslow, R., Artificial enzymes, 14:32086 (BA;US)
Bresser, T., Dutch priority programme on acidification: Summary report, Acidification research, 1984–1988, 14:31969 (R;NL)
Brett, C.E., Experience with chilled water storage in a water table aquifer, 14:30938 (RA;CA;In English and French)
Bretz, N.L., *See* Arunasalam, V., 14:32881
Brewer, R.E., *See* Wacker, G., 14:31132
Bridger, K., *See* Massuda, M., 14:31456
Bridger, N.J., *See* Turner, A.D., 14:30458
Bridges, F., Distorted chain sites for Co- and Fe-substituted $YBa_2Cu_3O_{7-\delta}$, 14:31308 (J;US)
Bridges, J., *See* Dev, H., 14:31998
Briggs, D., A calorimeter software trigger for the Mark II detector at SLC [Stanford Linear Collider], 14:31853 (R;US)
Brimacombe, R., *See* Nierhaus, K.H., 14:32146
Brimhall, J.L., *See* Sanders, T.L., 14:30580
Bringans, R. D., Bonding of Se and ZnSe to the Si(100) surface, 14:31379 (J;US)
Brinkerhoff, L.C., Technical safety appraisal of the Hanford Tank Farm Facility, 14:30526 (R;US)
Bristowe, P.D., *See* Majid, I., 14:32786
Brites, C.F., *See* Trindade, M.C., 14:32219
Britt, H.C., *See* Wilhelmy, J.B., 14:32681
Britton, K., Advances in fragmentation for in situ bed production, 14:30358 (RA;CN)
Significance of dilatancy to in situ bed preparation, 14:30359 (RA;CN)
Broadwater, R.P., *See* Reed, J.H., 14:30819
Brock, E.R., *See* Stygar, W.A., 14:31873
Brockmann, J.E., *See* Powers, D.A., 14:30921
Brodsky, S. J., *See* Bodwin, G. T., 14:32644
Broerse, J.J., *See* Bos, A.J.J., 14:31841
Broni, B., *See* Krug, R.M., 14:32111
Bronowski, D.R., *See* Madsen, M.M., 14:30592
See Yoshimura, H.R., 14:30602
Broo, A., *See* Larsson, S., 14:32178
Brooks, C.L. III, Thermodynamic calculations on biological molecules, 14:32191 (BA;US)
See Sneddon, S.F., 14:32179
Brossa, M., *See* Franconi, E., 14:32913
Browder, T. E., *See* Anjos, J. C., 14:32571, 14:32572
Brower, W.E. Jr., Metallic glasses as selective catalysts for synthesis of hydrocarbon liquids in high sulfur conditions: Final report, January 1–December 31, 1988, 14:30650 (R;US)
Brown, C. N., *See* Yoshida, T., 14:32579
Brown, C.H., *See* Collins, E.D., 14:30459
Brown, D.N., *See* Shore, S.N., 14:32453
Brown, E., Fiscal Year 1987 program report: Alaska Water Research Center, 14:32075 (R;US)
Brown, F.B., *See* Weatherford, C.A., 14:32482
Brown, K., *See* Bambade, P., 14:31723
Brown, K.W., Hazardous-waste land treatment, 14:31999 (R;US)
Brown, L. S., Higgs coupling and the decoupling theorem, 14:32640 (J;US)
Brown, M. R., *See* Siegrist, K., 14:32937
Brown, N.N., *See* Moya, J.L., 14:30598
Brown, R.A., Thermal-capillary model with axisymmetric fluid flow for analysis of Czochralski crystal growth of high Prandtl number materials: Final report, 14:31337 (R;US)
Brown, V., *See* Jakob, F.E., 14:31074
Brown, W.A., Mechanical systems evaluation, 14:31086 (R;CA;In English and French)
Broxton, D. E., Chemical and mineralogic trends within the Timber Mountain–Oasis Valley caldera complex, Nevada: Evidence for Multiple cycles of chemical evolution in a long-lived silicic magma system, 14:32427 (J;US)
See Warren, R. G., 14:32428
Bruenger, A.T., *See* Karplus, M., 14:32115

Bruening, R.L., *See* Izatt, R.M., 14:31428, 14:31439
Brug, W. P., *See* Chern, G., 14:31374
Bruhn, H., Methodology and first clinical application of localized proton spectroscopy in cases of brain tumors and ischemic insults, 14:32264 (RA;DD;In German)
Bruice, T.C., Porphyrin iron(III) mixed function oxidases: an evolutionary endpoint for transition metal(III) reactions with oxygen donors, 14:32134 (BA;US)
Brumfield, T.L., *See* Scott, T.C., 14:31424
Brumley, W.J., The Defense Waste Processing Facility, 14:30617 (BA;US)
Brun, T. O., *See* Kuriyama, K., 14:31264
Bruna, J., Computer tomography of the backbone in the radicular lumbosacral syndrome, 14:32306 (RA;DD)
See Brunova, J., 14:32254
See Srp, A., 14:32255
Brunie, S., *See* Achari, A., 14:32122
Brunner, P., *See* Minach, L., 14:32020, 14:32362
Bruno, J., *See* Puigdomenech, I., 14:31577
Brunova, J., Findings in diabetics examined by computed tomography, 14:32254 (RA;DD)
Brustein, M.R., *See* Berry, M.T., 14:31519
Bruus, H., Role of localization within the vortex picture of the fractional quantum Hall effect, 14:32828 (R;DK)
See Lindelof, P.E., 14:31330
Bruynseraede, Y., *See* Locquet, J., 14:31263
Bryant, D.A., Auroral electron accelerator. Manifestation of a universal ion/wave/electron interaction, 14:32479 (R;GB)
Bryant, H. C., *See* Tang, C. Y., 14:32525
Bryce, R.W., Borehole summary report for five ground-water monitoring wells constructed in the 1100 Area, 14:31967 (R;US)
Well installation and ground-water sampling plan for 1100 Area environmental monitoring wells, 14:31966 (R;US)
Buchali, K., Experience with /sup 15/N-NMR spectroscopy in animal experiments, 14:32265 (RA;DD;In German)
See Luening, M., 14:32222
Buchner, I., Standardization in radiation protection, 14:32765 (RA;AT;In German)
Buchtela, K., Experience with a continuously operating water sampling system, 14:31831 (RA;AT)
See Boeck, H., 14:30917
See Tschurlovits, M., 14:32073
Budai, J. D., X-ray study of in-plane epitaxy of $YBa_2Cu_3O_x$ thin films, 14:31311 (J;US)
Budan, O., Modeling of the behaviour under irradiation of the nuclear fuel containing thorium, uranium and plutonium oxides, 14:30436 (R;RO;In Romanian)
Budnick, J.I., *See* Zhang, Z., 14:31249
Buecheler, E., *See* Spielmann, R.P., 14:32280
Buecker, H., Dosimetry of space radiation and radiation problems in manned space flight, 14:32760 (RA;IL)
Buelow, S. J., *See* De Piante, A., 14:31886
Buelt, J.L., *See* Ward, A.L., 14:30615
Bugaev, K.A., Lepton pair emission as a probe for space-time scenario of quark-hadron phase transition, 14:32733 (R;SU)
Buhtz, C., Comparison of CT and lymphography in staging primary malignant lymphomas, 14:32296 (RA;DD;In German)
Bukanov, V.N., *See* Koval', G.N., 14:32763
Buldakov, L.A., Problems of regulating radiation exposure of the public, 14:30912 (RA;AT)
Bull, R.K., *See* Parker, R.C., 14:31587
Bullington, K.P., *See* Cole, D.A., 14:32349
Bunakov, V.E., On verification of t invariance in neutron reactions, 14:32723 (RA;SU;In Russian)
Bunnell, K., *See* Mir, R., 14:31852
Bunnell, L.R., *See* Ross, W.A., 14:30473
Buon, J., Depolarization enhancement due to the energy spread, 14:31719 (R;FR)
Burch, J.L., *See* Persoon, A.M., 14:32477
Burchat, P. R., *See* Klein, S. R., 14:32574
Burden, A.D., Calibration of imaging laser-induced fluorescence measurements in highly absorbing flames: an analytical reconstruction method, 14:31581 (R;SE)
Burgess, M., *See* Glass, R.E., 14:31611
Burke, D. L., *See* Hearty, C., 14:32577
See Klein, S. R., 14:32574
Burke, D.L., The Stanford Linear Collider, fall 1988, 14:31704 (R;US)
Burke, F.P., *See* Robbins, G.A., 14:30256
See Winschel, R.A., 14:30246, 14:30252, 14:30253, 14:30254, 14:30255, 14:30257, 14:30258, 14:30259
Burke, G.J., Numerical modeling of monopoles on radial-wire ground screens, 14:31878 (R;US)
Recent improvements to the model for wire antennas in the code NEC [Numerical Electromagnetics Code], 14:31879 (R;US)
Burke, J.M., *See* Been, M.D., 14:32093
Burke, T.M., *See* Harris, R.A., 14:30926
Burkert, V., LEP and CEBAF polarimeters: Revision, 14:31734 (R;US)
Burkhardt, R.W., *See* Parsley, M.J., 14:30693
Burks, C., *See* Lapedes, A., 14:32174
Burley, C.C., Method to directly measure maximum volume of fish stomachs or digestive tracts, 14:30696 (RA;US)
See Beyer, J., 14:30683
Burman, R. L., *See* Leitch, M. J., 14:32657
Burnham, A.K., *See* Oh, M.S., 14:30346
Burns, D.S., *See* Converse, A.O., 14:30731
Burns, J.A., *See* Gurnett, D.A., 14:32442
Burns, T.J., *See* Smith, M.S., 14:33029
Burson, S.B., *See* Powers, D.A., 14:30921
Burton, D.J., Health-hazard evaluation determination report No. 73-123-298, Campbell Plastics, Inc., Schenectady, New York, 14:31962 (R;US)
Burton, W.A., Steam turbine off-frequency operation, 14:30802 (R;CA)
Burwinkle, A.L., *See* Gill, J.T., 14:32954
Buryak, V.S., *See* Balakov, V.F., 14:31744
Buschbom, R.L., *See* Filipy, R.E., 14:32376
Busenitz, J. K., *See* Cason, N. M., 14:32557
Bush, D.M., *See* Morosin, B., 14:30968
Butler, D.M., Guide for preparing Safe Operating Procedures (SOPs), 14:30983 (R;US)
Butler, J., *See* Levi, M., 14:31777
Butler, M.K., A view of the evolving DOE software copyright policy, 14:32987 (R;US)
Butler, P.B., Real gas equations of state for CHEMKIN, 14:31335 (R;US)
Butler, T.D., *See* Amsden, A.A., 14:31161
Buttemer, D.R., *See* Campbell, R.D., 14:30902
Butz, C., *See* Grasshof, H., 14:32317
Buul, P.P.W. van, Genetic and biochemical basis of radiation sensitivity in cultured human and other mammalian cells, 14:32373 (RA;IL)
Byer, R. L., *See* Trail, J. A., 14:31885
Byers, C.H., Effects of particle shape and size distribution on sorption and flow performance in electrically stabilized expanded beds, 14:31449 (J;US)
See Harris, M.T., 14:32037
See Holmes, J.M., 14:31936
Byers, F. M., *See* Broxton, D. E., 14:32427
Byers, F. M., Jr., Volcanic centers of southwestern Nevada: Evolution of understanding, 1960–1988, 14:32425 (J;US)
See Warren, R. G., 14:32428
Byers, J.A., *See* Stallard, B.W., 14:32886
Bynum, M.T., Modeling of Brettanomyces clausenii growth on mixtures of glucose and cellobiose, 14:30712 (RA;US)
Byrd, R.C., An imaging detector for neutron or gamma sources, 14:31824 (R;US)
Byrne, A.P., *See* Stuchbery, A.E., 14:32678
Byrnes, S.J., A novel TR [transmit/receive] switch utilizing a distributed amplifier, 14:31870 (R;US)
Bystricky, J., *See* Naudet, C., 14:32659
Bywater, R.L. Jr., Measurement and fitting of pulse shapes of moderators at IPNS [Intense Pulsed Neutron Source]: Progress report, 14:30646 (R;US)

C

Cable, J. W., Spin dynamics of Gd at high temperatures, 14:31253 (J;US)

Cacas, M.C., Scale effect experiment in a fractured rock mass phase 2. Volume 2. Interpretation and modelling of the hydraulic tests carried out on the experimental site at Fanay-Augeres, 14:30556 (R;FR;In French)

Cacas, M.C., Ledoux, E., Scale effects experiment in a fractured rock mass phase 2. Volume 4. Interpretation and modelling of the tracer tests carried out on the experimental site at Fanay-Augeres, 14:30558 (R;FR;In French)

Cadilla, C.L. Harp, J., Preparation and characterization of soluble macronuclear chromatin from the hypotrich Euplotes eurystomus, 14:32198 (J;GB)

Cadwallader, L.C., *See* Casey, M.A., 14:32941

Cai Zuhuang, Applications of environmental tritium and carbon-14 in water resources investigation in Taiyuan region China, 14:32054 (RA;XA)

Cai, M., Industrial testing of retorting waste water treatment in towered biological filtration pond, 14:30419 (RA;CN)

Cairns, E.J., Energy Analysis Program: Annual report, FY 1988, 14:30971 (R;US)

Calander, K., Emission of carbon dioxide from anthropogenic sources in Sweden, 14:31926 (R;SE;In Swedish)

Caldwell, D. O., Two-photon formation of spin-one resonances and the nature of the *E*(1420), 14:32562 (J;US)

Calf, G.E., Tritium activity in Australian rainwater 1962-1986, 14:32050 (R;AU)

Callahan, P.M., *See* Heald, R.L., 14:31554

Callas, J. L., *See* Abe, K., 14:32569

Callaway, J.W., Evaluation of DOE's Partnership in Low-Income Residential Retrofit (PILIRR) Program, 14:31075 (R;US)

Callin, R.S., *See* Allen, M.A., 14:31771

Callis, E.L., High precision isotopic analyses of uranium and plutonium by total sample volatilization and signal integration, 14:31473 (R;US)

Calmels, P., Scale effect experiment in a fractured rock mass phase 2. Volume 3. Description of the tracer tests carried out on the experimental site at Fanay-Augeres, 14:30557 (R;FR;In French)

Calo, J.M., Packed bed hydrodynamics of an acid hydrolysis percolation reactor, 14:30659 (RA;US)

Calton, D.S., *See* Bowlen, K.L., 14:31073

Calvet, J.N., *See* Charissoux, C., 14:32784

Campa, A., New parametrization of the Kobayashi-Maskawa matrix and its implications, 14:32613 (J;US)

Campbell, D. S., Design and calibration of a local heat-flux measurement system for unsteady flows, 14:31661 (J;US)

Campbell, D.O., *See* Collins, E.D., 14:30459

Campbell, E. J., *See* De Piante, A., 14:31886

Campbell, R.D., Seismic margin assessment of the Catawba Nuclear Station: Volume 2, Appendixes: Final report, 14:30902 (R;US)

Canadell, E., *See* Wang, E., 14:31378

Canalini, A., Integrity of austenitic stainless steel piping welds for nuclear service, 14:30869 (R;BR)

Canavan, G.H., Constellation sizing for modest directed energy platforms, 14:33027 (R;US)

Directed energy weapons–lasers: Ground- and space-based systems, 14:33026 (R;US)

Goals for limited strategic defenses, 14:31899 (R;US)

Issues in the sequential deployment of strategic defenses, 14:31900 (R;US)

Candy, J. V., Model-based passive ranging, 14:32851 (J;US)

Cannon, T.W., *See* Weaver, N.L., 14:31091

Cannon, W.C., *See* Filipy, R.E., 14:32376

Canonico, A., Remote handling features of the PROTEO mock-up facilities for vitrified H.L.W. canisters, 14:30490 (RA;US)

Cantale, C., Characterization of a borosilicate glass incorporating MTR HLW with reference to the underground disposal, 14:30515 (RA;US)

Cantor, F., *See* Crandall, M.S., 14:31957

Cao, W., Effect of strain rate on the electroplastic effect in Nb, 14:31176 (R;US)

Cao, Z., Study of oxidation technique of oil shale, 14:30382 (RA;CN)

See Yang, Q., 14:30375

Capes, H., *See* Ghendrih, P., 14:32860

See Grosman, A., 14:32861

Capone, R.L., Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988, 14:30800 (R;US)

See Joy, D.S., 14:30523

Caporaso, G.J., *See* Prono, D.S., 14:31707

Cappelli, A., Ultraviolet emission from the sun and stars: a comparison of IUE and skylab spectra, 14:32449 (RA;FR)

Carajilescov, P., *See* Hirdes, V.R., 14:30837

Caramanis, M.C., WRATES, 14:31035 (J;US)

Carbaugh, E.H., *See* Sula, M.J., 14:32392

Cardoso, L.P., *See* Oliveira, J.B.B., 14:31208

Cargo, C.H., *See* Berglund, G.R., 14:30540

Carls, E.L., *See* Podolski, W.F., 14:30281

Carlsen, H., Puncturing results and plenum spectrometry on IFA 148 pins and bump tests 1-11: Risoe Fission Gas Project, 14:30872 (R;DK)

Carlsen, L., Analysis of low-pressure gas-phase pyrolytic reactions by mass spectrometric techniques, 14:31582 (R;DK)

Carlson, B.V., Multi-step direct multi-step compound description of fast particle induced reactions, 14:32711 (R;XA)

Carlson, J. M., Properties of earthquakes generated by fault dynamics, 14:32424 (J;US)

Carlson, N.M., *See* Smith, J.A., 14:31110

Carlson, R.V., Operating experience and procedures at the tritium systems test assembly, 14:32943 (J;US)

See Fisher, P.W., 14:32948

See Gruetzmacher, K.M., 14:32940

Carnahan, T.G., *See* Schultze, L.E., 14:31431

Carne, T.G., *See* Yoshimura, H.R., 14:30602

Carneiro, A.L.M., Advantage of uranium contained in low grade dolomite ore, 14:30427 (R;BR;In Portuguese)

Caron, P.R., Involvement of cryptic ATPase activity of UvrB and its proteolysis product, UvrB* in DNA repair, 14:32202 (J;GB)

Potential role of proteolysis in the control of UvrABC incision, 14:32201 (J;GB)

Carotenuto, A., Aquifer thermal energy storage experimental project in Italy, 14:30937 (RA;CA;In English and French)

Carpenter, D.E., *See* Shriner, D.S., 14:31921

Carpenter, J.M., *See* Bywater, R.L. Jr., 14:30646

Carr, R., *See* Sorensen, S. L., 14:32528

Carr, W. J., *See* Byers, F. M., Jr., 14:32425

Carrazza, J., *See* Marchon, B., 14:31523

Carrell, R.W., Serpins: evolution and adaptation in a family of protease inhibitors, 14:32130 (BA;US)

Carrera-Patino, M.E., *See* Salamon, P., 14:31325

Carreras, B.A., *See* Cary, J.R., 14:32900

See Charlton, L.A., 14:32862

See Lynch, V.E., 14:32863

Carrier, R.F., *See* Yalcintas, M.G., 14:32021

Carrington, M. E., Linear response of hot gluons, 14:32596 (J;US)

Carrisso, R.C., *See* Wodtke, R.M.P., 14:30342

Carroll, A. S., Peaks in the valley: Searching for resonances in large angle exclusive scattering, 14:32565 (J;US)

Carroll, J., *See* Naudet, C., 14:32659

Carson, D., *See* Gawlak, M., 14:30242

Carson, P., *See* Williams, P., 14:32210

Carstolu, M.F.C., Study of nuclear potentials used in heavy ions scattering, 14:32720 (R;RO;In Romanian)

Carter, M.W., Twenty-five years of alara, 14:32381 (RA;AT)

Carter, P., *See* Wells, J.A., 14:32144

Carter, R.J., Human factors issues related to expert systems for electric power plant control rooms, 14:30791 (R;US)

Cartier, F., *See* Menzel, H.G., 14:31842

Caruthers, C.M., *See* Boxberger, L.M., 14:32981

Carvalho, F.G., *See* Salgado, J., 14:30647

Cary, J.R., Application of modern mathematical concepts to plasma confinement: Progress report, 14:32865 (R;US)

Simple method for calculating island widths, 14:32900 (R;US)

Casagrande, L.G., *See* Lunt, S.R., 14:31524

Casali, D., *See* Franconi, E., 14:32913

Cascio, D., *See* Eisenberg, D., 14:32125

Case, G.N., *See* Moyer, B.A., 14:31417
Casey, M.A., The data collection system for failure/maintenance at the tritium systems test assembly, 14:32941 (J;US)
Cashdollar, K.L., *See* Hertzberg, M., 14:30417
Cashwell, J.W., *See* Finley, N.C., 14:30451
Cason, N. M., Hadroproduction of the iota meson observed in the $K_sK_s\pi^0$ final state, 14:32557 (J;US)
Casper, R.M., Evaluation of potential benefits of transportable storage casks: Final report, 14:30822 (R;US)
Caspi, S., *See* Gilbert, W.S., 14:31765
Cassa, J.C.S., *See* Martins, A.H., 14:31386
Castro, M.E., *See* Tecklenburg, R.E. Jr., 14:31401
Castrogivanni, M.A., *See* Banerjee, S., 14:30824
Catan, M., Review and findings of the Second EX-IEA Workshop on Solar Assisted Heatpumps Systems with Ground Coupled Storage, 14:30947 (RA;CA;In English and French)
Catford, W.N., *See* Ophel, T.R., 14:31802
See Woods, C.L., 14:32488, 14:32661
Caudell, M.B., Wildlife management assistance report: Progress report, July 1, 1988–June 30, 1989, 14:32027 (R;US)
Caurier, E., *See* Okolowicz, J., 14:32705, 14:32707
Causgrove, T.P., Electronic excitation transport in core antennae of enriched photosystem I particles from spinach chloroplasts, 14:31531 (J;US)
Excitation transport in glycerol solutions of rhodamine 640: absence of orientational correlation, 14:31541 (J;US)
Cavalier-Smith, T., Origin of cells: a symbiosis between genes, catalysts, and membranes, 14:32159 (BA;US)
Cavalieri, E.L., *See* Zamzow, D., 14:32402
Cavanagh, R., Why utilities should promote DSM while choking on capacity surplus, 14:31012 (RA;US)
Caves, D.W., Importance of market segmentation in new service and rate offerings, 14:31023 (RA;US)
Cecchini, A., *See* Andreani, R., 14:32908
See Pizzuto, A., 14:32911
Cech, T.R., *See* Been, M.D., 14:32093
Cecille, L., New alternative processes for the treatment of the alkaline solvent wash waste, 14:30456 (RA;US)
Celata, C., *See* Judd, D.L., 14:32924
Celentano, F., *See* Franconi, E., 14:32913
Cena, R.J., Oil shale retorting in dense phase hot-solid recycle systems, 14:30351 (RA;CN)
Centre de Recherches Nuc, *See* Haas, F. 5Strasboug-1 Univ., 67, 14:32655
Ceperley, D.M., *See* Amato, M.A., 14:32803
Cerruti-Sola, M., *See* Cappelli, A., 14:32449
Cha, C.Y., Eastern oil shale conversion using the ROPE [Recycle Oil Pyrolysis and Extraction] process, 14:30370 (R;US)
Cha, Y.S., Numerical simulation of natural circulation phenomena in a PWR during TMLB' transients prior to core damage, 14:30877 (R;US)
Chabriais, J., *See* Moreau, J.F., 14:32274
Chacham, H., *See* Alves, J.L.A., 14:32790
Chadwick, R.B., Synergistic solvent extraction of manganese by macrocyclic crown ethers in combination with didodecylnaphthalene sulfonic acid: effect of macrocycle substituents, 14:31416 (J;US)
Chaiko, D.J., Monolayer behavior of hydroxyoxime extractants, 14:31419 (J;US)
Thermodynamic modeling of chemical equilibria in metal extraction, 14:31420 (J;US)
Chakraborty, A., Specific heat of $Bi_2Sr_2CuO_6$ and $Bi_2Sr_2CaCu_2O_8$ in the superconducting state, 14:31309 (J;US)
Chakravarti, B., Trace constituents in landfill gas. Task report on corrosion potential. Final report, May 1984-June 1985, 14:30652 (R;US)
Chalhoub, E.S., Generation and tests of the new version 88 library for HAMMER system, 14:32994 (R;BR;In Portuguese)
See Anaf, J., 14:32995
Chamberlain, J., Developing a pricing strategy: the case of nonutility generation, 14:31029 (RA;US)
Chambers, A.K., Review of the literature on experimental studies of the pyrolysis and hydropyrolysis of coal, 14:30244 (R;CA)
Chambers, D.I., *See* Wilson, S.W., 14:31624
Chambre, P.L., *See* Light, W.B., 14:30567
Champagne, B., *See* Moreau, C., 14:31284
Champagne, R.D., Participation of the Hydrogen Industry Council. At the round table of the Fuel Cell Workshop, 14:31045 (RA;CA)
Chan Hongmo, Fundamentally new physics at the Tevatron Collider?, 14:32592 (R;GB)
Chan, C.H., *See* Takahashi, Y., 14:32680
Chan, C.S., *See* Saulys, A.C., 14:31804
Chan, K. C. B., *See* Lichti, R. L., 14:31301
Chan, S., Tandem helium plasma spectrometry with a capacitively coupled discharge formed above a helium ICP, 14:32889 (J;US)
Chan, T.F., Domain decomposition algorithms and computational fluid dynamics, 14:32531 (J;US)
Chan, V., *See* Mayberry, M.J., 14:32871
Chandra, S., Prospects for Australian involvement in the nuclear fuel cycle, 14:30453 (R;AU)
Chandrasekaran, A., *See* Reed, J.H., 14:30819
Chandrasekhar Rao, M.V.S, *See* Sastry, D.L., 14:32498
Chandrashekhar, B., *See* Kothekar, V., 14:32190
Chandry, P.S., *See* Belfort, M., 14:32204
Chaney, W.R., *See* Knudson, D.M., 14:30984
Chang, C.S., Anisotropic distribution function of minority tail ions generated by strong ion-cyclotron resonance heating, 14:32884 (R;US)
Chang, D., Constraints on muonium-antimuonium conversion, 14:32605 (J;US)
Chang, K.C., *See* Johnson, T.C., 14:30633
Chang, Ming-Ming, *See* Honarpour, M., 14:30293
Chang, Y., Saturation of intersubband transitions in *p*-type semiconductor quantum wells, 14:32812 (J;US)
See Wilson, S.W., 14:31624
Chang, Y. C., *See* Shi, D., 14:31300
Chang, Y.I., *See* Till, C.E., 14:30849
Changchien, L.M., *See* Holler, H.F., 14:32149
Chant, V.G., *See* Arthurs, D.M., 14:30942
Chao, Y., Understanding and improving the high field orbit in the Fermilab Booster, 14:31715 (R;US)
Chapman, C.C., *See* Hutcherson, M.N., 14:30508
Chapman, J., *See* Freeman, M., 14:31105
Chapman, M.S., *See* Eisenberg, D., 14:32125
Chapman, R., *See* Fifield, L.K., 14:32662
Charissoux, C., Review of the utilization of laser and electron beam methods in the nuclear domain, 14:32784 (R;FR;In French)
Charles, I.G., *See* Creighton, T.E., 14:32128
Charlton, L.A., Magnetic fluctuations due to pressure driven instabilities in ATF, 14:32862 (R;US)
Charuau, J., Choice of treshold values triggering the decontamination procedure in nuclear plants working places, 14:32769 (RA;AT)
Chatterjee, R., *See* Paul, R., 14:31477
Chau, H.H., *See* Osher, J.E., 14:31623
Chauhan, S.P., *See* Muralidhara, H.S., 14:31455
Chechetkin, V.M., *See* Lyutostanskij, Yu.S., 14:32457
Cheetham, A.K., *See* Harrison, W.T.A., 14:31295
Chen Shuming, *See* Zhou Shunli, 14:31805
Chen Tingyang, *See* Gu Weizu, 14:31993
Chen, C. T., *See* Sette, F., 14:31367
Chen, H.C., A discussion on using Lanczos vectors and Ritz vectors for computing dynamic responses: Final report, Part I: Final report, 14:31620 (RA;US)
Solution of viscously damped linear systems using a set of load-dependent vectors: Final report, Part II: Final report, 14:31621 (RA;US)
Vibration analysis of fluid-solid systems using a finite element displacement formulation: Final report, Part III: Final report, 14:31619 (RA;US)
Chen, J., Factors affecting the results of Fischer assay of oil shale, 14:30381 (RA;CN)
See Patel, D., 14:31364
Chen, Y., Fluid-bed boiler burning particulate Maoming oil shale, 14:30401 (RA;CN)
See Gonzalez, R., 14:31366
Chen, Yu-Jiuan, *See* Prono, D.S., 14:31707
Chenais-Popovics, C., *See* Willi, O., 14:32896

Cheng Caie, Applied research on developing groundwater sources with Po-210 detecting instrument, 14:32070 (RA;XA)
Cheng, C.C., *See* Cappelli, A., 14:32449
Cheng, H., Laboratory studies into the use of the scandium-46-EDTA complex as a tracer for groundwater flow, 14:32066 (RA;XA)
Cheng, H.Y., *See* Aronson, S., 14:32581
Cheng, K. T., *See* Mansour, N. B., 14:32521
Cheng, Yisun, *See* Chiang, Shiao-Hung, 14:30273
Cheong, S., *See* Aronson, M. C., 14:31305
Cheong, S.W., *See* Arko, A.J., 14:31393
Cherdack, R., *See* Rossmassler, R.L., 14:32942
See Tuohy, J.M., 14:32946
Cherdack, R.N., Technical aspects of the upgrade and commissioning of the tritium and related systems at TFTR, 14:32944 (J;US)
Cheremnykh, O.K., On theory of stability of flute modes in a tokamak with β/sub e/ $\simeq$ 1, 14:32877 (R;SU;In Russian)
Chern, G., Surface phonon modes of the RbBr(001) crystal surface by inelastic He-atom scattering, 14:31374 (J;US)
Cherniak, D. J., *See* Ryerson, F. J., 14:32436
Chernichenko, V.A., *See* Isaenko, V.I., 14:32762
Chernovitz, A.C., Isotopic dependence of recombination kinetics in water, 14:31573 (J;US)
Cherry, J.M., *See* Doudna, J.A., 14:32096
Cherubini, A., *See* Glass, R.E., 14:31611
Cheu, E., *See* Mir, R., 14:31852
Cheung, P. Y., Short–time-scale evidence for strong Langmuir turbulence during hf heating of the ionosphere, 14:32480 (J;US)
Chi, H., *See* Zhao, Y., 14:30396
Chiang, Shiao-Hung, Dewatering of fine coal refuse: Final report, August 1985–December 1987, 14:30273 (R;US)
Chicken, J.C., Final report on a study of coherence in acceptability criteria for the technical aspects of risks associated with potentially hazardous installations, 14:30903 (R;FR)
Chikovani, Z.E., Geometrical model of multiple production, 14:32586 (R;SU)
Chikunov, V.V., *See* Knyazev, B.A., 14:32921
See Voropaev, S.G., 14:32874
Ching, W. Y., *See* Zhao, G., 14:31248
Chiperzak, D.B., *See* Hopky, G.E., 14:32439
Chirico, R.D., *See* Steele, W.V., 14:30310, 14:30311, 14:30313
Chiu, S.C., *See* Mayberry, M.J., 14:32871
Chiu, T.M., *See* Ju, S.J., 14:30430
Chmelka, B.F., Probing metal cluster formation in NaY zeolite by ^{129}Xe NMR, 14:31508 (J;US)
Chmely, F., *See* Kuang, Y., 14:32526
Choi, Jor Shan, *See* Alesso, H.P., 14:32754
Choi, K., Wormhole solution to the strong *CP* problem, 14:32621 (J;US)
Choi, U.S., Friction-reducing additive scale-up experiments in a pilot-scale DHC system simulator, 14:31136 (R;US)
Chong, S., *See* Wu, R., 14:30389
Chongvisal, V., *See* Vanichseni, S., 14:30400
Chopovskij, L.L., Study on the /sup 3/H + α and /sup 3/He + α elastic scatterings in a state with zero orbital moment, 14:32734 (R;SU)
Chothia, C., Evolution of protein structures, 14:32117 (BA;US)
Chou, C.H., *See* Trahanovsky, W.S., 14:31536
Chou, P.T., *See* Braathen, G., 14:31537
Chouha, M., *See* Duchemin, B., 14:30856
Chouw, N., Vibration transmission behaviour of reinforced concrete components under extreme impact stresses, 14:30922 (R;DE;In German)
Chow, M., Functional performance, 14:31079 (R;CA;In English and French)
Christensen, C.P., *See* Gordon, C.L., 14:31638
Christensen, L., *See* Caves, D.W., 14:31023
Christensen, P., Inexpensive selective absorber produced in Denmark, 14:30757 (R;DK;In Danish)
Christensen, T.M., Atmospheric corrosion inhibition, 14:31666 (BA;US)
Christiansen, B., *See* Alstroem, P., 14:32829, 14:32830, 14:32831
See Andresen, J.E., 14:32816
Christiansen, H., Environmental aspects. Development of a computer model for environmental impact of energy production, 14:32002 (R;DK;In Danish)
Christopfel, W.C., *See* Kenny, P.W., 14:31509
Christou, C. T., *See* Lanen, J. B. J. M., 14:32660
Christou, G., *See* Fish, R.H., 14:30706
Chrostek, W.J., Health-hazard evaluation determination report No. 75-87-280, Kawecki Berylco Industries, Inc., Reading, PA, 14:31943 (R;US)
Health-hazard evaluation determination report No. 76-33-431, 76-34-431, Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia, 14:31944 (R;US)
Chu, P.J., Characterization of interstitial hydrogen within metal clusters in $Zr_6Cl_{12}H$ and $ZrClO_xH_y$ by solid-state nuclear magnetic resonance, 14:31518 (J;US)
Chudacek, Z., Diagnosis of pulmonary embolism using CT, 14:32289 (RA;DD;In German)
Chum, H.L., Lignin characterization - a summary progress report, 14:30736 (RA;US)
Lignin conversion - an overview, 14:30734 (RA;US)
See Black, S., 14:30666
See Johnson, D.K., 14:30737
See Ratcliff, M.A., 14:30735
Chun, P.W., Approximation of the Planck-Benzinger thermal work function in protein refolding in ribonuclease systems, 14:32193 (BA;US)
Chung, S. U., Search for A J^{PC} exotic hybrid meson, 14:32566 (J;US)
See Blessing, S., 14:32559
See Boehnlein, A., 14:32564
Church, M., *See* Hartouni, E. P., 14:32561
Chyu, M. -C., Horizontal-tube falling-film evaporation with structured surfaces, 14:31660 (J;US)
Cieslak, M.J., The solidification metallurgy of Alloy 718 and other Nb-containing superalloys, 14:31227 (R;US)
Claeson, T., *See* Bridges, F., 14:31308
Claesson, B., *See* Schrire, D., 14:30832
Clapp, A., *See* McCann, W.J., 14:32956
Clark, D.J., The production of beams from solid materials at the LBL ECR source, 14:31758 (R;US)
Clark, G.A., *See* Nash, K.L., 14:31571
Clark, J.C., Aligning the magnetic field of a linear induction accelerator with a low-energy electron beam, 14:31729 (R;US)
See Prono, D.S., 14:31707
Clark, J.W., *See* Sokol, P.E., 14:32835
Clark, R. E. H., *See* Zetner, P. W., 14:32522
Clark, S.K., Nonlinear viscoelastic characteristics of polymeric materials: Final report, September 1, 1986–February 28, 1989, 14:31319 (R;US)
Clark, T.L., *See* Langley, R.A., 14:32899
Clarke, J., *See* Wellstood, F. C., 14:31625
Clarkson, G.P., *See* Ophel, T.R., 14:31802
Claro, L.H., Pseudo-harmonics method: an application involving perturbations caused by control rod insertion in PWR reactors, 14:30874 (R;BR)
Clausen, E.C., *See* Prieto, S., 14:30662
Clausing, R.E., *See* O'Hern, M.E., 14:31317
Claussen, C., NMR imaging and CT of the spinal canal, 14:32298 (RA;DD;In German)
See Bittner, R., 14:32284
See Sander, B., 14:32224
Claussen, C.D., *See* Kaminsky, S., 14:32234
Clayden, N.J., *See* James, A.C.W.P., 14:31481
Clayton, C.R., *See* Diegle, R.B., 14:31292
Clayton, R., N_2O field study. Final report, 14:30810 (R;US)
Clegg, S., *See* Noemmik, H., 14:32003
Clendenin, J.E., High-yield positron systems for linear colliders, 14:31769 (R;US)
Clifft, B.E., *See* Bogaty, J.M., 14:31692
Clift, W.A., *See* Gill, J.T., 14:32954
Cline, J., Renormalization of the δ expansion of $\lambda(\phi^{2+2\delta})_2$ theory, 14:32639 (J;US)
Cline, J.E., Direct assay of drummed evaporator bottoms, dry active waste, and filter cartridges at the Ginna Nuclear Station, 14:30462 (RA;US)
Close, E., *See* Judd, D.L., 14:32924
Close, F. E., Exotic mesons, 14:32600 (J;US)
Clower, T.J., *See* Godbee, H.W., 14:30474

Cobb, J.K., *See* Early, R.A., 14:31775
Cobet, H., Detection of isolated bronchoceles by CT, 14:32287 (RA;DD;In German)
Coburn, T.T., Isothermal pyrolysis and char combustion of oil shales, 14:30343 (RA;CN)
See Oh, M.S., 14:30346
Cochran, H.D., Theoretical models of thermodynamic properties of supercritical solutions, 14:31493 (J;US)
See Gilbert, V.P., 14:31492
Cocu, F., *See* Dei-Cas, R., 14:31731
Codrington, J.B., Energy storage on the supply side or the demand side, 14:30927 (R;CA)
Coelho, P.E.F.P., Radiogeologic reconnaissance in Perus region, Sao Paulo, Brazil, 14:31991 (R;BR;In Portuguese)
Coffey, H.E., Solar-Geophysical Data Number 438, February 1981. Part 2 (comprehensive reports). Data for August 1980 and miscellanea, 14:32461 (R;US)
Coffield, F., *See* Prono, D.S., 14:31707
Coffin, D.O., A tritium-compatible piezoelectric valve for the Tokamak Fusion Test Reactor, 14:32949 (J;US)
The safety record at the tritium systems test assembly, 14:32936 (J;US)
See Fisher, P.W., 14:32948
Coffre, C., *See* Vanel, D., 14:32329
Cohen, A., *See* Rowe, M.S., 14:30986
Cohen, D. D., *K*- and *L*-shell ionization cross sections for deuterons calculated in the ECPSSR theory, 14:32512 (J;US)
Cohen, H., *See* Masarwa, M., 14:31501
Cohen, J., Effective Lagrangian approach to K^*-nucleon scattering and K^+ photoproduction, 14:32741 (J;US)
Cohen, M.F., *See* Coleman, J.B., 14:33004
Cohen, S., *See* Tang, C. Y., 14:32525
Cohn, E.R., Beta operation: a parallel primitive. Doctoral thesis, 14:32977 (R;US)
Cole, A., *See* Willi, O., 14:32896
Cole, D.A., Copper-67 labeled porphyrin localization in inflamed tissues, 14:32349 (R;US)
Cole, D.W., *See* Van Miegroet, H., 14:30701
Cole, E.I. Jr., Resistive Contrast Imaging applied to multilevel interconnection failure analysis, 14:31675 (R;US)
Cole, S.P., *See* Carlson, R.V., 14:32943
See Coffin, D.O., 14:32949
Colella, P., *See* Bell, J.B., 14:32530
Coleman, J.B., Change Control of software at LANL, 14:33004 (R;US)
Colestock, P., *See* Chang, C.S., 14:32884
Collard, M., Role of the MRI in medical imaging - socio-economical analyses, 14:32250 (RA;DD)
Colle, S., *See* Vaz Junior, M., 14:30851
College, J., *See* Babu, M., 14:30803
Collier, D.M., *See* Casper, R.M., 14:30822
Collier, J.C. Jr., Integrated resource planning: who's going to do it?, 14:31025 (RA;US)
Collins, C. L., *See* Bonin, K. D., 14:32520
Collins, E.D., Improved ion exchange method for treatment of slightly contaminated wastewaters, 14:30459 (RA;US)
Collins, J., *See* Loew, G., 14:32181
Collins, J.C., Theoretical studies in elementary particle physics: Progress report, March 1988–January 1989, 14:32584 (R;US)
Collins, J.M., *See* Michalske, T.A., 14:31290
Collins, L., *See* Hendler, A., 14:31958
Collman, J., *See* Dickinson, P. H., 14:31296
Colombo, P., *See* Franz, F.M., 14:30480
See Heiser, J.H. III, 14:30454
Colonna, N., *See* Moretto, L.B., 14:32670
Colton, E., *See* Auer, I. P., 14:32575
Colvin, C.M., *See* Hedley, W.H., 14:32951
Combis, P., *See* Bourgade, J.L., 14:31179
Combs, S.K., *See* Fisher, P.W., 14:32948
Comfort, J. R., *See* Leitch, M. J., 14:32657
Connell, P.S., Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint, 14:31974 (R;US)
Connolly, P.J., Population dynamics of walleye and smallmouth bass and potential on salmonid smolts in John Day Reservoir, 14:30689 (RA;US)
Conrad, H., *See* Cao, W., 14:31176
Conrad, M., Quantum mechanics and molecular computing: mutual implications, 14:32195 (BA;US)
Conrad, R., *See* Flipot, A.J., 14:32904
Conroy, K.W., Application of decontamination solution process methods, 14:30475 (RA;US)
Contesso, G., *See* Vanel, D., 14:32329
Contre, M., *See* Charissoux, C., 14:32784
Converse, A.O., Effect of thermo-chemical pretreatment on the enzymatic hydrolysis of lignocellulosic substrates I, 14:30731 (RA;US)
Conway, J.C. Jr., *See* Kirchner, H.P., 14:31288
Cook, N.G.W., *See* Zheng, Z., 14:32432
Cooke, D. W., *See* Heffner, R. H., 14:31252
See Lichti, R. L., 14:31301
Cooke, D.W., High-frequency cavity applications and measurements of high-temperature superconductors, 14:31333 (R;US)
Cooley, J.N., Nondestructive assay measurements of gaseous diffusion process equipment, 14:30625 (R;US)
Coombe, R.D., *See* Ongstad, A.P., 14:31562
Coons, B., *See* Pusch, R., 14:30608
Coop, K.L., A combined thermal/epithermal neutron interrogation device to assay fissle materials in large containers, 14:31598 (R;US)
Cooper, E.N., *See* Lucas, R.P. Jr., 14:31982
Cooper, R.S., Fluorescence line narrowing spectrometry of nucleoside-polycyclic aromatic hydrocarbon adducts on thin-layer chromatographic plates, 14:31458 (J;US)
See Zamzow, D., 14:32402
Cooper, W. E., *See* Yoshida, T., 14:32579
Coppersmith, S. N., Phase diagram of the Hubbard model: A variational wave-function approach, 14:32808 (J;US)
Copus, E.R., *See* Powers, D.A., 14:30921
Corbet, A.D.W., Treatment and handling of intermediate and low level radioactive liquid wastes, 14:30471 (RA;US)
Corbet, B., Radiant heating potential of Vortek arc lamps, 14:31133 (R;CA)
Corbett, J.D., *See* Chu, P.J., 14:31518
Corcuera, R.P., Calculation of nuclear parameters for some heavy isotopes, 14:30858 (R;BR;In Portuguese)
Comments on MC/sup 2/-2 and MINX computer codes, 14:32990 (R;BR;In Portuguese)
Cordes, M., *See* Hosten, N., 14:32257
Cords, H., *See* Funke, T., 14:31214
Corley, J.P., *See* Alexander, J.A., 14:31701
See Denison, G.J., 14:32931
See Ramirez, J.J., 14:32930
Cornell, J.C., Neutron beam facility at NAC, 14:32972 (R;ZA)
Cornish, T.J., Experimental link between the ^{13}C NMR chemical shift of carbonyl carbons and the energy shifts observed in the n → 3s optical transition of cyclic ketones, 14:31533 (J;US)
Correa, F.P.R., *See* Hamel, H.J.E., 14:30868
Corredoura, P., *See* Ronan, M.T., 14:31792
Costa, A.C.S., *See* Oliveira, J.C.M. de, 14:31814
Cotton, T.M., *See* Heald, R.L., 14:31554
See Kim, J.H., 14:31520
See Lu, T., 14:31542
Couch, W.A., Proceedings of the annual solar thermal technology research and development conference, 14:30753 (R;US)
Counce, R.M., *See* Crawford, D.B., 14:31425
Coupal, D.P., *See* Boyarski, A., 14:31854
Courville, G. E., Techniques for *in situ* determination of thermal resistance of lightweight board insulations, 14:31658 (J;US)
Cowgill, M.G., Materials and degradation modes in an alternative LLW [low-level waste] disposal facility, 14:30455 (R;US)
Cowley, S.C., *See* Ratcliff, M.A., 14:30735
Cox, B., Prospects for B physics spectroscopy in Fermilab fixed target experiments, 14:32556 (J;US)
Cox, D. E., *See* Axe, J. D., 14:31303
See Hemley, R. J., 14:31370
Cox, D. L., *See* Chakraborty, A., 14:31309
Cox, D.R., *See* Turner, A.D., 14:30458
Cox, H.M., InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)
See Morais, P.C., 14:31230
Cox, J.E., *See* Blake, J.B., 14:32746

Cox, L., *See* Long, J.C.S., 14:32433
Cox, L. E., 4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
Cox, R.A., *See* Hall, I.W., 14:31512
Crabol, B., Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)
Craievich, A.F., *See* Santos, D.I. dos, 14:32748
Craig, G., *See* Dickinson, P. H., 14:31296
Craig, G.D., *See* Whittum, D.H., 14:31722
Craik, C.S., *See* Higaki, J.N., 14:32140
Cramer, B.M., Staging of prostatic cancer by NMR imaging, 14:32294 (RA;DD;In German)
Crandall, M.S., Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Crasemann, B., *See* Mau Hsiung Chen, 14:32511
See Sorensen, S. L., 14:32528
Crawford, A.M., *See* Lau, K.C., 14:30929
See Mirza, C., 14:30957
Crawford, D.B., Depletion of aqueous nitrous acid in packed towers, 14:31425 (J;US)
Crawford, E.P., *See* Tharp, W.H., 14:30973
Crawford, F. S., Applications of Bohr's correspondence principle, 14:32846 (J;US)
Crawford, R.W., *See* Oh, M.S., 14:30346
Creighton, J.R., A mechanism for selectivity loss during tungsten CVD, 14:31350 (J;US)
Creighton, T.E., Biosynthesis, processing, and evolution of bovine pancreatic trypsin inhibitor, 14:32128 (BA;US)
Cremaldi, L. M., *See* Anjos, J. C., 14:32571, 14:32572
Cremonesi, P., *See* Zamzow, D., 14:32402
Cripps, R.C., *See* Furrer, M., 14:30920
Crittenden, J. A., *See* Yoshida, T., 14:32579
Crittenden, R., *See* Blessing, S., 14:32559
See Chung, S. U., 14:32566
Crocker, M.E., *See* Noll, L.A., 14:30292
Cross, J.B., Oxidation of MoS_2 by thermal and hyperthermal atomic oxygen, 14:31331 (R;US)
Crow, K.R., Glass melter feed system for vitrification of radioactive waste, 14:30521 (RA;US)
Crozier, E. D., *See* Freund, J., 14:31256
Crutcher, J.W., Results of the independent verification of radiological remedial action at 480 South Main Street, Monticello, Utah (MS00049), 14:32022 (R;US)
Cruz, C., *See* Banerjee, S., 14:30824
Csanak, G., *See* Zetner, P. W., 14:32522
Csorna, S. E., *See* Bortoletto, D., 14:32573
Cullen, D., Development of an efficient high-brightness $Ti:Al_2O_3$ laser amplifier. Final report, 15 August 1987-14 February 1988, 14:31626 (R;US)
Cullick, A.S., Modified corresponding states method for predicting densities of petroleum reservoir fluids, 14:30294 (J;US)
Culver, G., Drilling and well construction, 14:30768 (RA;US)
Well pumps, 14:30770 (RA;US)
See Rafferty, K.D., 14:30776
See Stiger, S.G., 14:30769
See Wright, P.M., 14:30760
Cumming, I.W., *See* Cecille, L., 14:30456
Cumming, N.A., *See* Seabrook, P.T., 14:31664
Cummings, D.G., *See* McCaffrey, R.R., 14:31433
Cunha Menezes Filho, A., Program of evaluations for nuclear data centers, 14:30859 (R;BR;In Portuguese)
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)
Generation of one energy group cross section library with MC/sup 2/ computer code, 14:30860 (R;BR;In Portuguese)
Cunningham, B.C., *See* Wells, J.A., 14:32144
Cunningham, R.A., *See* Fifield, L.K., 14:32662
Cuny, J., *See* Stygar, W.A., 14:31873
Currie, I.G., *See* Pon, C.J., 14:30815
Curry, A., *See* Haigh, C.P., 14:30479
Curtiss, L. A., *See* Ruscic, B., 14:31479
Cushman, R., *See* Edmonds, J., 14:31920
Cutts, D., *See* Abe, K., 14:32569
Cuzzi, J.N., *See* Gurnett, D.A., 14:32442
Cvetkovic, O., *See* Vitorovic, D., 14:30376
Cwynar, J.C., *See* Smeltzer, E.E., 14:30466
Cyr, D.R., *See* Ramaiah, D., 14:31555
Czelusniak, J., *See* Goodman, M., 14:32166
Czernuszewicz, R.S., Oxomanganese(IV) porphyrins identified by resonance Raman and infrared spectroscopy: weak bonds and the stability of the half-filled t_{2g} subshell, 14:31499 (J;US)
See Su, Y.O., 14:31498

D

D'Amore, J., *See* Aston, D., 14:32549, 14:32551, 14:32558
Dabos, S., *See* Gerward, L., 14:31326, 14:31328
See Staun Olsen, J., 14:31327
Dabrowski, B., Composition of superconducting $La_2CuO_{4+\delta}$: A superconductor doped by excess oxygen defects, 14:31270 (R;US)
See Loong, C., 14:31302
DaCosta, D.H., Economics of PVC incineration, 14:30488 (RA;US)
Dahl, K., *See* Tellkamp, H., 14:32246
Dahlgren, L., Spectral measurement SMHI. Final report, 14:31877 (R;SE;In Swedish)
Dahmen, U., The use of heteroepitaxy in the fabrication of bicrystals for the study of grain boundary structure, 14:31298 (J;US)
Dai, H., *See* Zhao, Y., 14:30396
Dai, H.L., *See* Lin, S.H., 14:31517
Daigle, J.-Y., Reclamation options for abandoned commercial peatlands, 14:30276 (R;CA;In English and French)
Daily, W., An evaluation of cross-borehole resistivity tomography, 14:32423 (R;US)
Dainty, E.D., Derivation of the brake-specific ventilation equation and on operating load factor expression relevant to the use of diesel machinery underground, 14:31917 (R;CA)
Dal Mut, G., *See* Pizzuto, A., 14:32911
Dale, B.E., Mechanisms of plant cell wall resistance to polysaccharide degrading enzymes: a study using nuclear magnetic resonance analysis, 14:30730 (RA;US)
Dalenback, J., *See* Catan, M., 14:30947
Dalgarno, B.G., Study of defect centres in irradiated optical fibre glasses by electron spin resonance spectroscopy, 14:31315 (R;GB)
Dallaire, S., *See* Moreau, C., 14:31284
Dalton, J.T., *See* Morris, J.B., 14:30519
Dam, A.S., *See* Bowles, C.R., 14:30489
Damgaard, P.H., *See* Alfaro, J., 14:32619
Dan'shin, V.P. and other, *See* Alferov, V.N., 14:31741
Dana, M.T., The MAP3S Precipitation Chemistry Network: Data and quality control summary for 1986 and 1987, 14:31968 (R;US)
Danevich, F.A., *See* Vasilenko, V.V., 14:31818
Daniels, E.J., *See* Krumpelt, M., 14:31049
Danielsen, E., *See* Christiansen, H., 14:32002
Danko, G. A., *See* Long, G. G., 14:31890
Dannhauer, K.H., Exercise-induced changes of the articular cartilage diagnosed by /sup 1/H-NMR relaxation spectroscopy, 14:32268 (RA;DD;In German)
Danzer, G.D., *See* Mallick, P.K., 14:31522
Darroudi, F., *See* Buul, P.P.W. van, 14:32373
Das Gupta, S., *See* Ghosh, D., 14:31320
Das, A., A systematic study of the Toda lattice, 14:32843 (J;US)
Das, P.K., *See* Ramaiah, D., 14:31555
Das, S., *See* Lee, R., 14:30301
Das, S. G., *See* Garner, J., 14:32813
Das, T., *See* Scheiner, S., 14:32188
Dasgupta, P.K., *See* Genfa, Z., 14:31405
Datz, S., Atomic physics using large electrostatic accelerators, 14:32490 (R;US)
See Schulz, M., 14:32516
Davenport, J. W., *See* Watson, R. E., 14:31250
See Weinert, M., 14:31258
Davenport, R.C. Jr., *See* Alber, T.C., 14:32139
David, R.A., Sandia's UGT Instrumentation Development Program: INWET'89 Paper No. 15, 14:31876 (R;US)
Davidovich, M.A., *See* Klausner, J.C., 14:32792

Davidovskij, V.G., Theory of ion deceleration in magnetized temperature-anisotropic electron plasma, 14:31718 (R;SU;In Russian)
Davidson, R. M., *See* Benmerrouche, M., 14:32603
Davidson, R.C., Waves and instabilities in noneutral plasmas, 14:32864 (R;US)
Davidson, W., A static cylindrically symmetric solution for perfect fluid in general relativity, 14:32850 (J;US)
Davies, R.H., *See* Wilkinson, A.J., 14:32182
Davies, R.W., Internal guide sequence and reaction specificity of group I self-splicing introns, 14:32095 (BA;US)
Davis, D.S., Prevention reference manual; chemical specific. Volume 13. Control of accidental releases of methyl isocyanate. Final report, June 1987-September 1988, 14:31945 (R;US)
Davis, N., *See* Wertz, G.W., 14:32113
Davis, R. J., X-ray-absorption study of the interaction of hydrogen with clusters of supported palladium, 14:31304 (J;US)
Daw, M.S., *See* Baskes, M.I., 14:31342
Dawson, J. M., *See* Lembege, B., 14:32538
See Wilks, S. C., 14:31710
Dawson, J.W., Development of Radhard VLSI electronics for SSC calorimeters, 14:31800 (R;US)
Dawson, S., The search for a heavy Higgs boson, 14:32580 (R;US)
Day, J.E., Transportable volume reduction bitumen solidification system from design to operation, 14:30467 (RA;US)
de Andrade, J.B., *See* Tanner, R.L., 14:31978
de Guerra, E. M., *See* Zamick, L., 14:32742
de Menorval, L.C., *See* Chmelka, B.F., 14:31508
De Piante, A., Pulsed molecular-beam, diode-laser spectrometry using rapid scanning techniques, 14:31886 (J;US)
Deadrick, F.J., *See* Clark, J.C., 14:31729
Debbe, R., MWPC with highly segmented cathode pad readout, 14:31803 (R;US)
Debus, R.J., Site-directed mutagenesis identifies a tyrosine radical involved in the photosynthesized oxygen-evolving system, 14:32196 (J;US)
Dechant, G., Field method for detemining thorium-230 in soils, 14:30627 (R;US)
Decker, J.R., *See* Filipy, R.E., 14:32376
Decker, T., *See* Luening, M., 14:32222
Decman, D.J., *See* Roy, N., 14:32682
DeFord, J.F., *See* Whittum, D.H., 14:31722
DeFrees, J.A., Field evaluation of high-efficiency gas furnaces. Final report, 14:30323 (R;US)
Degani, M. H., *See* Loong, C., 14:31302
Degani, M.H., Excitons in GaAs-Ga/sub 1-x/Al/sub x/As quantum wells, 14:32793 (RA;BR)
DeGrado, W.F., Design of a four-helix bundle protein, 14:32129 (BA;US)
Del-Cas, R., Requirements of high-surface electric fields for high-brightness Fel injectors, 14:31731 (R;FR)
Del Bene, J.E., Ab initio molecular orbital study of hydrogen bonding and ion-molecule association in model systems for DNA bases, 14:32187 (BA;US)
Delamater, N., *See* Willi, O., 14:32896
Delayen, J.R., Heavy-ion superconducting linacs, 14:31693 (R;US)
DeLong, T., Freeze sealing (plugging) of piping: A guide for nuclear power plant maintenance personnel, 14:30867 (R;US)
Deme, S., *See* Andrasi, A., 14:32016
Demirgian, J.C., The potential of continuous emission monitoring of hazardous waste incinerators using Fourier transform infrared spectroscopy, 14:31919 (R;US)
Dempsey, J.C., *See* Kotrappa, P., 14:31064
DeMuth, S.F., Uranium and zirconium mass transfer testing of 5.5-cm-diam centrifugal contactors, 14:30446 (J;US)
Denison, G.J., Performance of the Hermes-III laser-triggered gas switches, 14:32931 (R;US)
See Alexander, J.A., 14:31701
See Ramirez, J.J., 14:32930
Dennis, B.S., Hanford environmental dose reconstruction project: Monthly report, 14:32390 (R;US)
Hanford Environmental Dose Reconstruction Project: Monthly report, May 1989, 14:32391 (R;US)
Dennis, C.B., *See* Krumpelt, M., 14:31049
Depken, J.C., AGS experiments, 1986, 1987, 1988, 14:32542 (R;US)
Derrickson, J.H., *See* Takahashi, Y., 14:32680
Deruyter, H., Damped accelerator structures for future linear $e^{\pm}$ colliders, 14:31772 (R;US)
See Allen, M.A., 14:31771
Deshmukh, P.C., *See* Manson, S.T., 14:32486
Despois, J., *See* Housse, B.A., 14:30933
Deublein, G., Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)
Dev, H., Radio-frequency enhanced decontamination of soils contaminated with halogenated hydrocarbons, 14:31998 (R;US)
Devanesan, P., *See* Zamzow, D., 14:32402
Devell, L., Determination of radioactive emission origins based on analyses of isotopic composition, 14:31987 (R;SE;In Swedish)
Devkin, B.V., *See* Sal'nikov, O.A., 14:32646
DeVolpi, A., Neutron-gamma hodoscope detection of fissile materials, 14:30631 (R;US)
Dewes, P., Fabrication, pre-irradiation characterization and base-irradiation data of test fuel rod group PK1X: The Super-Ramp Extenstion Project, 14:30843 (R;SE)
The Studsvik Super-Ramp Extension Project: Complementary post-irradiation examinations of KWU/CE rods at Karlstein, 14:30829 (R;SE)
The Studsvik Super-Ramp Extension Project: Destructive post-irradiation examinations of rod group PK 1X, 14:30836 (R;SE)
Dewey, C., Comparison between MRI of transplanted kidneys and histological results, 14:32292 (RA;DD)
Dynamic MRI of transplanted kidneys after application of Gd-DTPA, 14:32276 (RA;DD)
See Markwardt, J., 14:32315
See Planitzer, J., 14:32275, 14:32338
See Schmidt, D., 14:32230
See Stuerzer, I., 14:32311, 14:32314
See Zschenderlein, R., 14:32248
DeWolf, G.B., *See* Davis, D.S., 14:31945
Dhamodaran, R., *See* Srinivasan, T.G., 14:30445
Diakonov, D. I., Singlet dilambda in the chiral theory, 14:32616 (J;US)
Diaz, F., *See* Dod, R.L., 14:31933
DiBella, F., Open cycle heat pump development for local resource use Phase II district heating case study analysis: Progress report, 1 January 1989–30 March 1989, 14:31137 (R;US)
Dick, R., Stripping voltammetry of technetium(VII) by means of a glassy carbon electrode chemically modified with a TPAC loaded copolymer film, 14:31392 (R;DE;In German)
Dickinson, J.R., *See* Uncapher, W.L., 14:30593
Dickinson, P. H., Chemical vapor deposition of $YBa_2Cu_3O_{7-x}$ superconducting films, 14:31296 (J;US)
Diebold, T. C., *See* Johnson, S. A., 14:31415
Diegert, K.V., *See* Easterling, R.G., 14:33009
Diegle, R.B., An XPS study of the passivity of an amorphous Co-20P alloy, 14:31292 (BA;US)
See Wilde, B.E., 14:31236
Dielhof, J.B., *See* Bos, A.J.J., 14:31841
Dierkes, L., Activity concentration in the discharge of a sewage purification plant, 14:30918 (RA;AT;In German)
Dihlmann, W., Native CT of the soft parts of the shoulder, 14:32327 (RA;DD;In German)
Diller, T. E., *See* Campbell, D. S., 14:31661
Dillmann, C.W., Design and fabrication experience with the AZTECH radwaste equipment, 14:30472 (RA;US)
See McKeehan, E.R., 14:30478
DiMarco, J., *See* Akerlof, C., 14:32462
Dimitrov, Z., *See* Genov, H., 14:32245
Dimov, G.I., *See* Bel'chenko, Yu.I., 14:32919
Ding, F., *See* Wang, J., 14:30341
Dinneen, T., *See* Mansour, N. B., 14:32521
Dios L, M. de, Landau levels and cyclotron masses in Ga Al-Al Ga As quantum wells, 14:32822 (RA;BR)
DiRenzo, A.B., *See* Sampson, J.R., 14:32103
DiSalvo, F. Jr., Synthesis and properties of novel cluster phases: Progress report ending June 30, 1989, 14:31471 (R;US)
Ditscherlein, W., *See* Dewey, C., 14:32292
Dittner, P. F., *See* Schulz, M., 14:32516
Ditzler, W. R., *See* Auer, I. P., 14:32575

Diwan, M. V., *See* Abe, K., 14:32569
Dixon, R., Peatland inventory of Manitoba. 3. Interlake region using Landsat v thematic mapper, 14:30277 (R;CA)
Djuric, G., *See* Popovic, D., 14:32383
Djurle, S., The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1984–February 28, 1985, 14:30831 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, March 1, 1985–September 30, 1985, 14:30833 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1985–March 31, 1986, 14:30835 (R;SE)
The Studsvik Super-Ramp Extension Project: Power ramp irradiation of test fuel rod group PK1X, 14:30844 (R;SE)
Dock-Bregeon, A.C., Conformational changes and dynamics of tRNAs: evidence from hydrolysis patterns, 14:32091 (BA;US)
Dod, R.L., The LBL/AGMEF/JSU El Yunque Environmental Research Initiative, 14:31933 (R;US)
Dodds, D.J., *See* Zimmerman, R.M., 14:30589
Dodelson, S., *See* Bernstein, J., 14:32466
Dodson, G., *See* Beise, E. J., 14:32658
Doerfel, H.R., 25 years of in vivo measurements of transuranes at KFK, 14:31844 (RA;AT;In German)
25 years of reference measurements in the Karlsruhe whole-body counter: /sup 137/Cs in man, /sup 60/Co in steel, /sup 226/Ra and /sup 232/Th in paper, 14:32012 (RA;AT;In German)
Doh, J.Y., Long-term prediction of radionuclide leaching from waste matrix by finite-slab approximation method, 14:30465 (RA;US)
Dohrmann, D.R., Market study of commercial appliances: Volume 1, Assessment of commercial appliance efficiency improvements: Final report, 14:31059 (R;US)
Doke, T., *See* Kohno, T., 14:32475
See Nagata, K., 14:32473
Dolgikh, B.P., *See* Grishanov, B.I., 14:31749
Dolgov, A.D., Does static solution exist for a gravitating flat wall, 14:32825 (R;SU)
Doll, J. D., *See* Xie, J., 14:31485
Doll, P., Annual report on nuclear physics activities. July 1, 1987 - June 30, 1988, 14:32648 (R;DE)
Domanus, H.M., *See* Cha, Y.S., 14:30877
Domingue, R.P., *See* Dorfman, R.C., 14:31556
Dominguez, N., *See* Lynch, V.E., 14:32863
Dominici, G., Radiocesium in wheat of the Po plain, 14:31983 (R;FR;In Italian)
Donahue, J. B., *See* Tang, C. Y., 14:32525
Donato, A., Strategy and progress in the treatment of LILW in Italy, 14:30461 (RA;US)
See Cantale, C., 14:30515
Dong-hui, S., Review of research and development of high level liquid waste vitrification in China, 14:30504 (RA;US)
Donohue, M.L., *See* Younker, L.W., 14:30612
Doolittle, R.F., Reconstructing the evolution of vertebrate blood coagulation from a consideration of the amino acid sequences of clotting proteins, 14:32165 (BA;US)
Doolittle, W.F., What introns have to tell us: hierarchy in genome evolution, 14:32169 (BA;US)
Dorfman, R.C., Photoinduced electron transfer and back transfer in systems of randomly distributed donors and acceptors: picosecond transient grating experiments, 14:31556 (J;US)
Dorner, H., Provisions and active measures to preclude guillotine breaks in piping systems of pressurized water reactors, 14:30905 (R;BR)
Dorsett, R.S., *See* Holland, M.K., 14:30441
Doudna, J.A., Genetic dissection of an RNA enzyme, 14:32096 (BA;US)
Dougherty, L., *See* Joy, D.S., 14:30523
Dougherty@f—, R. L., Nonnegativity-, monotonicity-, or convexity-preserving cubic and quintic hermite interpolation, 14:33017 (J;US)
Doughty, C., Investigation of the vertical flow aquifer thermal energy storage concept and numerical simulation of the Dorigny field experiment, 14:30936 (RA;CA;In English and French)
Dover, C. B., Anomalous ϕ production in $N\bar{N}$ annihilation: Four-quark exotics or $ss\bar{}$ components in the nucleon?, 14:32606 (J;US)
Exotic mesons in $\bar{N}N$ annihilation, 14:32555 (J;US)
Dowling, D.T., *See* Olsen, D.K., 14:31786
Doyle, H.N., *See* Lainhart, W.S., 14:30284
Doyle, R.D., *See* Day, J.E., 14:30467
Dozol, J.F., *See* Cecille, L., 14:30456
Dracoulis, G.D., *See* Stuchbery, A.E., 14:32678
Draxler, J., *See* Ruppert, M., 14:31429
Dreher, W., *See* Schneider, W., 14:32262
Drew, S.M., *See* Koval, C.A., 14:30268
Drickamer, H.G., *See* Roginski, R.T., 14:31503, 14:31504
Drobnitzky, M., *See* Bohndorf, K., 14:32316
Drobot, A., *See* Gover, A., 14:31648
Drotning, W.D., *See* Roth, E.P., 14:32929
Drozdz, S., *See* Okolowicz, J., 14:32705, 14:32707
Drumm, P.V., *See* Fifield, L.K., 14:32662
See Hebbard, D.F., 14:32695
Drummond, S.E., *See* Palmer, D.A., 14:31538
Dryer, F.L., *See* Glassman, I., 14:31579
Du, C., *See* Nuttall, H.E., 14:30353
Duan Qi, Application of stable isotopes to hydrogeology in coal mine, 14:32063 (RA;XA)
Duan Yucheng, *See* Duan Qi, 14:32063
Duarte, C.L., *See* Hiromoto, G., 14:30624
Duba, A. G., *See* Schock, R. N., 14:32437
DuBois, D. F., *See* Cheung, P. Y., 14:32480
Dubur, G.Ya., *See* Ivanov, E.V., 14:32374
Duchemin, B., French studies for improvement of the data for radioactive sources, 14:30856 (R;FR)
Duda, S., *See* Bittner, R., 14:32284
Dudek, L.E., *See* Kamperschroer, J.H., 14:32928
Dudkin, A., *See* Mani, S.A., 14:31711
Dudnikov, V.G., *See* Bel'chenko, Yu.I., 14:32919
Dudziak, S., *See* Bjornstad, B.N., 14:32001
Duerbeck, H.W., *See* Bode, M.F., 14:32447
Duffy, R.E., Verification analysis of the toroidal accelerator rotor platform wind energy conversion system. Summary report, 14:30789 (R;US)
Dufrane, K.H., Licensed centralized low level waste incinerator facility, 14:30485 (RA;US)
Duir, J.H., *See* Reeg, C.P., 14:30362
Duke, S.D., *See* Hansel, H.C., 14:30692
See Poe, T.P., 14:30684
Dumesic, J.A., Experimental and kinetic modeling of acid/base and redox reaction over oxide catalysts: Annual report, 14:31276 (R;US)
Duncan, J.H., The use of stereo optical flow fields in the determination of three-dimensional motion and stereo correspondence: Progress report, May 1988–April 1989, 14:31595 (R;US)
Dung, N.V., Fluidized-bed retorting of Australian oil shales, 14:30390 (RA;CN)
Dunham, M. E., Saturation behavior of silicon Auston switches, 14:31884 (J;US)
Dunigan, T.H., A remote host facility for Intel hypercubes, 14:33007 (R;US)
Dunkerton, L.V., Regioselective synthesis of substituted 1-thiohex-2-enopyranosides, 14:31487 (J;US)
Dunn, D.M., *See* Weiss, R.B., 14:32148
Dunn, J.J., *See* Kuhn, R.J., 14:32197
Dunwoodie, W., *See* Aston, D., 14:32549, 14:32551, 14:32558
Durand, E., Scale effect experiment in a fractured rock mass phase 2. Volume 1. Description of hydraulic tests carried out on the experimental site at Fanay-Augeres, 14:30555 (R;FR;In French)
Durant, F., *See* Boulanger, T., 14:32189
Durell, J.L., *See* Fifield, L.K., 14:32662
Durham, W. B., *See* Ryerson, F. J., 14:32436
Durkin, L. S., *See* Abe, K., 14:32569
Duryea, G., *See* Holden, M.S., 14:31652
Dushin, V.N., Mathematical modelling of extraction dynamics in differential-contact extractor, 14:31576 (R;SU;In Russian)
Duthie, J.G., *See* Takahashi, Y., 14:32680
Dutta, J.M., Dielectric measurements of selected ceramic materials at 245 ghz, 14:31267 (R;US)
Dutta, S., Laser-written metallization patterns for solar cell applications, 14:31340 (BA;US)
Duval, V., *See* Coburn, T.T., 14:30343
Dwivedi, S.R., *See* Gupta, H.C., 14:32747

Dyachenko, P.P., Absolute measurements of the prompt neutron spectrum produced by spontaneous fission of /sup 252/Cf in the low-energy region, 14:32689 (RA;XA)
Dyer, A., Inorganic anion exchangers for the treatment of radioactive wastes, 14:30532 (R;GB)
Organic resin anion exchangers for the treatment of radioactive wastes, 14:30533 (R;GB)
Dymock, K.R., Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
Dyni, J.R., Hydroretorting, rock-eval, and Fischer assay analyses of some world oil shales, 14:30383 (RA;CN)
Dzierba, A., *See* Blessing, S., 14:32559
See Chung, S. U., 14:32566

E

Earl, W.L., *See* Engelke, R., 14:31539
Early, R.A., Design calculations and measurements of a dipole magnet with Permendur pole pieces, 14:31775 (R;US)
Easterling, R.G., System-based component test plans and operating characteristics: Introduction and overview, 14:33009 (R;US)
Easterling, W., *See* Edmonds, J., 14:31920
Eastman, J.A., *See* Mader, W., 14:31244
Eaton, W.C., Quality-assurance audits of the EPA (Environmental Protection Agency) state-operated precipitation-collection network: 1987, 14:31950 (R;US)
Ebersberger, J., *See* Felsenberg, D., 14:32236
Ebert, W.L., *See* Bates, J.K., 14:30611
Ebner, F., *See* Kressel, H.Y., 14:32295
Ebrahim, A., *See* Blotcky, A.J., 14:31459
Eby, P.B., *See* Takahashi, Y., 14:32680
Eckardt, R., *See* Pronko, M., 14:32926
Eckert, H., Glassy carbons from poly(furfuryl alcohol) copolymers: structural studies by high-resolution solid-state NMR techniques, 14:31511 (J;US)
Eckert, J., *See* Nicol, J.M., 14:31545
Eckhause, M., *See* Kuang, Y., 14:32526
Eckman, R.M., *See* Mikkelsen, T., 14:31909
Edelman@f—, A., *See* Dougherty@f—, R. L., 14:33017
Eden, J.G., *See* McCown, A.W., 14:31646
Edlund, O., *See* Crabol, B., 14:31981
Edmonds, J., Criteria for selecting a CO_2/climate change region of study, 14:31920 (R;US)
Edwards, L.L., Simulations of cloud condensation droplet nucleation and growth, 14:31910 (R;US)
Edwards, N.T., Fate and effects of PAHs in the terrestrial environment: An overview, 14:31995 (R;US)
Edwards, R. Jr., Design and testing of the Defense Waste Processing Facility melter drain valve, 14:30507 (RA;US)
Eenink, A.H., *See* Matteman, J.L., 14:30487
Efthimion, P.C., *See* Arunasalam, V., 14:32881
Ehrlich, D., Dose rates of waste packagings. A manual for activity determination of single radionuclide mixtures in standardized waste packagings resulting from dose rate limits, 14:30574 (R;DE;In German)
Ehrlich, D.J., Recent developments in the methods and applications of reactive laser-direct-patterning techniques, 14:31339 (BA;US)
See Tsao, J.Y., 14:31341
Ehrlich, H.G., *See* Kroeger, W., 14:30910
Eichholz, G.G., Tritium penetration through concrete, 14:30618 (J;US)
Eigen, G., Observation of CHI/sub b/ and CHI/sub b/' production in exclusive decays of the Y' and Y" with the CUSB detector at the Cornell e/sup +/e/sup -/ storage ring, 14:32547 (R;DE)
Eigen, M., New concepts for dealing with the evolution of nucleic acids, 14:32107 (BA;US)
Einerson, J.H., Comparison of laboratory performances, 14:32049 (J;US)
Einziger, R.E., *See* Sanders, T.L., 14:31606
Eiras, J.A., *See* Menegazzo, B.A., 14:31280
Eisch, J.J., Bimetallic promotion of cooperative hydrogen transfer and heteroatom removal in coal liquefaction: Quarterly technical progress report, December 1, 1988–February 28, 1989, 14:30263 (R;US)
Eischens, R.P., Infrared study of carbon deposits on bimetallic catalysts: Final report, September 1, 1986–August 31, 1989, 14:31467 (R;US)
See Najbar, J., 14:31182
Eisele, F.L., Identification of ions near HVDC [high-voltage direct-current] transmission lines: Final report, 14:32403 (R;US)
Eisele, J.A., *See* Schultze, L.E., 14:31431
Eisenberg, B.M., Comparison of cerebral SPECT with CT in diagnosis of acute cerebrovascular insufficiency, 14:32335 (RA;DD;In German)
Eisenberg, D., Some evolutionary relationships of the primary biological catalysts glutamine synthetase and RuBisCO, 14:32125 (BA;US)
Eisenbud, M., Highlights in the evolution of radiation protection practices, 14:32764 (RA;AT)
Eisenbud, N., Environmental radioactivity, 14:30879 (RA;BR)
Eisenstatt, L.R., *See* Smeltzer, E.E., 14:30466
Ekholm, N.I., *See* Hecktor, B.O., 14:31135
El-Rayes, I., *See* Wang, J., 14:31552
Elam, W. T., *See* Idzerda, Y. U., 14:31247
Elander, R.T., Mixing requirements for enzymatic hydrolysis of cellulose, 14:30713 (RA;US)
Elber, R., *See* Karplus, M., 14:32115
Elderfield, H., Geochemistry and mobility of the lanthanides in marine sediments, 14:32051 (R;GB)
Ellefson, R.E., Measurement and prediction of tritium holdup, 14:32955 (J;US)
Ellermann, J., Influence of pentoxifylline on recovery of rat ischemic kidneys as evidenced by /sup 31/P-NMR spectroscopy, 14:32266 (RA;DD;In German)
Ellingson, W.A., Development of magnetic resonance imaging technology for imaging binder distribution in ceramics, 14:31272 (R;US)
See Ackerman, J.L., 14:31863
Ellington, A.D., *See* Benner, S.A., 14:32084
Elliott, J. R., *See* Anjos, J. C., 14:32571, 14:32572
Elliott, N.E., *See* Johnson, K.A., 14:31297
Ellis, P.F. III, Materials selection guidelines, 14:30775 (RA;US)
Ellis, R.P., Visualization and stoichiometry of the active-enzyme cellulase complex from Trichoderma reesei, 14:30719 (RA;US)
Ellis, V.L., *See* Bowles, E.C., 14:30679
Ellison, P.G., *See* Hutcherson, M.N., 14:30508
Elsden, A.D., *See* Woodall, A., 14:30498
Emery, K.A., SERI results from the PEP 1987 Summit Round Robin and a comparison of photovoltaic calibration methods, 14:30738 (R;US)
Emmett, E.A., *See* Hervin, R.L., 14:31960
Endorf, R., *See* Aston, D., 14:32549, 14:32551, 14:32558
Engel, J., *See* Vogel, P., 14:32611
Engelhardt, W.E., Radiation versus transport losses in fusion devices, 14:32916 (RA;BR)
Engelke, R., Production of the nitromethane aci ion by static high pressure, 14:31539 (J;US)
Engert, D.E., Attaching IBM-compatible 3380 disks to Cray X-MP, 14:32986 (R;US)
Englert, P., *See* Arnold, J.R., 14:32458
Enk, J., *See* Dev, H., 14:31998
Enomoto, M., Retorting of four kinds of small size oil shale with an inclining type retort, 14:30352 (RA;CN)
Ensley, E.K., Heats of dissolution of tar sand bitumen in various solvents, 14:30392 (R;US)
Ensor, D.D., Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)
Ent, R., *See* Lanen, J. B. J. M., 14:32660
Enterline, P.E., *See* Lainhart, W.S., 14:30284
Entine, G., *See* McCann, W.J., 14:32956
Eppley, K.R., *See* Allen, M.A., 14:31771
Eppley, R.W., Primary production, nutrients, and particulate matter in the southern California bight: Contributions to the C, N, and O_2 budgets: A component of the California Basin Study (CaBS): [Progress report, November 1988], 14:32438 (R;US)
Epstein, A. J., *See* Chakraborty, A., 14:31309

Epstein, L.M., Transcripts of newt satellite DNA self-cleave in vitro, 14:32102 (BA;US)
Erber, T., Resonance fluorescence and quantum jumps in single atoms: Testing the randomness of quantum mechanics, 14:32844 (J;US)
Erck, R.A., Applications of ion beam processes in tribology, 14:31187 (R;US)
Erdemir, A., *See* Erck, R.A., 14:31187
Erdmann, E., *See* Rienmueller, R., 14:32279
Erich, E., *See* Schulz, H., 14:30264
Erickson, M.D., *See* Demirgian, J.C., 14:31919
Erickson, R., *See* Bambade, P., 14:31730
See Kent, J., 14:31778
Ericsson, G., Disposal of radioactive waste in land burial facilities at Studsvik. Inspection notes, 14:30641 (R;SE;In Swedish)
See Bergman, C., 14:30640
Eriksson, A., Brunkeberg aquifer thermal storage in central Stockholm, 14:30935 (RA;CA;In English and French)
Eriksson, J., *See* Olsson, O., 14:30609
Erlemann, R., *See* Reiser, M., 14:32312
Erlstroem, M., *See* Pusch, R., 14:30608
Erven, C.C., Development of improved sheath cross-bonding joint protectors for self-containing underground cables, 14:30814 (R;CA)
Erzberger, A., Bibliographic study on molybdenum biokinetics, 14:32396 (R;DE;In German)
Escobar, C. O., *See* Anjos, J. C., 14:32571, 14:32572
Esherick, P., Polarization effects in diode-laser-pumped Nd, 14:31640 (BA;US)
Espenson, J.H., *See* Masarwa, M., 14:31501
Estabrooks, P., *See* Anjos, J. C., 14:32571, 14:32572
Estell, D.A., *See* Wells, J.A., 14:32144
Ethridge, J.L., Effects of fast neutron irradiation on thermal conductivity of Li_2O and $LiAlO_2$, 14:32915 (R;US)
Etkin, A., *See* Cason, N. M., 14:32557
See Saulys, A.C., 14:31804
Eucker, P., *See* Mote, J.D., 14:30804
Euske, J.M., *See* Dunkerton, L.V., 14:31487
Evans, A., *See* Bode, M.F., 14:32447
Evans, G.B., *See* Brown, K.W., 14:31999
Evans, J. W., Comment on "Kinetics of random sequential adsorption", 14:32806 (J;US)
Evans, J.P., *See* Morris, J.B., 14:30519
Evans, J.V., *See* Lowson, R.T., 14:30620
Evans, M., Symmetry in string theory, 14:32624 (J;US)
Evelyn, J.C., *See* Bentley, J.C., 14:31017
Evlanov, M.V., Processes of inelastic collision of composite particles with nonspherical nuclei, 14:32736 (R;SU;In Russian)
Evrard, J.M., Expert systems for analysis and management assistance of nuclear reactor electrical power supplies, 14:30863 (R;FR)
Ewing, R.C., *See* Jercinovic, M.J., 14:30604
Extermann, P., *See* Hearty, C., 14:32577

F

Faber, J. Jr., *See* Harrison, W.T.A., 14:31295
Facius, R., *See* Buecker, H., 14:32760
Fackler, O., *See* Kasameyer, P., 14:32842
Fahr, A., Ultraviolet absorption of the vinyl radical and reaction with oxygen, 14:31567 (J;US)
Fahy, L.J., *See* Cha, C.Y., 14:30370
Fallor, R.A., Comments on the gas-phase initial rate of tritiated water formation, 14:32962 (J;US)
Fairman, R., *See* Shoemaker, K.R., 14:32116
Faison, B.D., Coal solubilization by lower fungi, 14:30248 (R;US)
Fajer, J., *See* Barkigia, K.M., 14:32185
Fajer, R.W., *See* Roberts, J.M., 14:31411
Faler, M.P., Effects of variation in flow on distributions of northern squawfish in the Columbia River below McNary Dam, 14:30694 (RA;US)
Falk, L., *See* Olsson, O., 14:30609
Fallas, T.T., *See* McKeehan, E.R., 14:30478
Faltens, A., *See* Judd, D.L., 14:32924
Fan Shiguo, *See* Zhou Shunli, 14:31805
Fan Zhicheng, Review of data of oxygen and hydrogen isotope composition in thermal waters in China, 14:32064 (RA;XA)
Fan, W., *See* Yang, Q., 14:30375
Fang, S.R., *See* Chiang, Shiao-Hung, 14:30273
Fant, K.S., *See* Allen, M.A., 14:31771
Farber, R., *See* Lapedes, A., 14:32174
Farkas, D., Grain-boundary ordering, segregation, and melting transitions in a two-dimensional lattice-gas model, 14:32809 (J;US)
Farkas, Z.D., Dynamics of an electron in an rf gap, 14:31725 (R;US)
Farnand, B.A., Preferential adsorption and selective permeation of alcohol/hydrocarbon mixtures in reverse osmosis, 14:31430 (J;US)
Farneth, W. E., *See* Chakraborty, A., 14:31309
Farnsworth, R.K., Model predictions of glass fracturing in canisters during decontamination, 14:30520 (RA;US)
Farr, J. D., *See* Cox, L. E., 14:31368
Farrell, B., Passage of the Low-Level Radioactive Waste Act Amendments of 1985, 14:30632 (RA;US)
Farrell, R.F., *See* McCann, W.J., 14:32956
Fatyga, B. W., Grassmann-valued fluid dynamics, 14:32849 (J;US)
Faucheux, G., *See* Vergnaud, T., 14:32982
Fauske, H.K., *See* Hutcherson, M.N., 14:30508
Fayer, M.D., *See* Dorfman, R.C., 14:31556
Fazzio, A., *See* Scolfaro, L.M.R., 14:32791
Fee, E.J., Phytoplankton primary production and related limnological data for lakes and channels in the Mackenzie Delta and lakes on the Tuktoyaktuk Peninsula, N.W.T., 14:32028 (R;CA)
Feenstra, R., *See* Budai, J. D., 14:31311
Feenstra, R. M., *See* McLean, A. B., 14:31377
Feher, I., *See* Andrasi, A., 14:32016, 14:32019
See Nagy, G., 14:31830
Fehl, D.L., A 1-D, hard x-ray pinhole camera for flash x-ray pulsed-power accelerators, 14:31869 (R;US)
A one-dimensional scintillator camera for the SATURN x-ray simulation accelerator, 14:31851 (R;US)
See Stygar, W.A., 14:31873
Feinendegen, L.E., *See* Sondhaus, C.A., 14:32367
Feingold, M., Semiclassical structure of Hamiltonians, 14:32856 (J;US)
Felt, M. D., Simple spectral method for solving propagation problems in cylindrical geometry with fast Fourier transforms, 14:32845 (J;US)
Feitosa, J.A., *See* Noguti, I., 14:31388
Fejgin, A.S., *See* Romanov, V.A., 14:31738
Feldman, B.J., *See* Gordon, C.L., 14:31638
Feldman, D.W., Recent experiments with the free-electron laser at Los Alamos, 14:31628 (R;US)
Feldman, G.J., *See* Boyarski, A., 14:31854
Feldman, M.J., Remote maintenance for waste handling: application of servomanipulators to a new generation of hot cells, 14:30438 (RA;US)
Feldman, W.C., *See* Arnold, J.R., 14:32458
Feldmeier, H., Gross properties of nuclei and nuclear excitations. Proceedings, 14:32722 (R;DE)
Feliu, L., *See* Dod, R.L., 14:31933
Felix, R., *See* Bittner, R., 14:32284
See Henkes, H., 14:32336
See Hosten, N., 14:32257
See Kaminsky, S., 14:32234
See Sander, B., 14:32224
See Schoerner, W., 14:32244
Felker, L.K., Fluorine gettering by activated charcoal in a radiation environment, 14:31448 (J;US)
Felsenberg, D., Reduction of artefacts in CT diagnosis caused by metallic implants, 14:32236 (RA;DD;In German)
Felske, D., *See* Kasameyer, P., 14:32842
Feng, D.F., *See* Doolittle, R.F., 14:32165
Feng, X., Effects of composition on the leach behavior of West Valley HLW glasses, 14:30522 (RA;US)
Fenske, G.R., *See* Erck, R.A., 14:31187
Ferguson, J., *See* Robinson, W.A., 14:32218
Ferguson, R.L., *See* Albrecht, R., 14:32706
Fermi, G., *See* Perutz, M.F., 14:32133

Fernandes, A.A.R., *See* Biasi, R.S. de, 14:32795
Fernando, G. W., *See* Watson, R. E., 14:31250
See Weinert, M., 14:31258
Fernow, R., *See* Blessing, S., 14:32559
See Boehnlein, A., 14:32564
See Chung, S. U., 14:32566
Ferrande, R., *See* Boileau, Y., 14:30948
Ferraz, E.S.B., Nuclear energy and the environment, 14:30880 (R;BR;In Portuguese)
Ferreira, C.L., *See* Biasi, R.S. de, 14:32795
Ferreira, J.G., Atomic fluorescence yields W/sub M4/, W/sub M5/, W/sub N4/ and W/sub N5/ of the elements Ir,Pt,Au,Th and U, 14:32497 (RA;BR)
See Ferreira, J.L., 14:32781
Ferreira, J.L., Experimental studies on the surface confined quiescent plasma at INPE, 14:32781 (RA;BR)
Ferreira, S.O., Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)
Ferris, J.P., Prebiotic synthesis: problems and challenges, 14:32081 (BA;US)
Ferro, C., New design for the coupling structures in FTU. Technological problems, 14:32912 (RA;IT)
Fetisov, N.I., *See* Sal'nikov, O.A., 14:32646
Feuston, B. P., Topological and bonding defects in vitreous silica surfaces, 14:31354 (J;US)
Fewell, M.P., Coulomb excitation of the 4/sup +//sub 1/ states of /sup 194/Pt, /sup 196/Pt and /sup 198/Pt, 14:32677 (R;AU)
See Lim, C.S., 14:32679
Fidler, A.T., *See* Crandall, M.S., 14:31957
Fieguth, T., *See* Bambade, P., 14:31723
Fieguth, T.H., The optical design of the spin manipulation system for the SLAC Linear Collider, 14:31726 (R;US)
Fiehn, B., *See* Smailos, E., 14:30566
Fields, D.E., Prediction of radiation effects from proposed low-level waste disposal sites in Turkey, 14:32023 (J;US)
See Yalcintas, M.G., 14:32024
Fields, D.J., *See* Wilhelmy, J.B., 14:32681
Fields, L.W., *See* Cooley, J.N., 14:30625
Fierke, C.A., Implications for enzymic catalysis from free-energy reaction coordinate profiles, 14:32142 (BA;US)
Fierro, C., Electron donor-acceptor properties of porphyrins, phthalocyanines, and related ring chelates: a molecular orbit approach, 14:31540 (J;US)
Fieuw, G., *See* Govaerts, P., 14:32013
Fifield, L.K., Mass of /sup 37/P, 14:32662 (R;AU)
See Ophel, T.R., 14:31802
See Woods, C.L., 14:32488, 14:32661
Figueiredo Filho, N., *See* Jayanthi, U.B., 14:31798
See Villela, T., 14:31797
Figueiredo, M.C.H. de., Geology and Geochemistry of the Poco de Fora region-Curaca river valley-Bahia-Brazil, 14:32415 (R;BR;In Portuguese)
Fihey, J.L., *See* Tinkler, M.J., 14:31671
Filipova, H., *See* Lizler, J., 14:32282
Filipy, R.E., Inhaled ^{147}Pm and/or total-body gamma radiation: Early mortality and morbidity in rats, 14:32376 (R;US)
See Scott, B.R., 14:30909
Finck, R., Resuspension of radionuclides during cultivation. Results from a single sample analysis, Spring 1987, 14:32007 (R;SE;In Swedish)
Findahl, O., What did they say? on radio and TV about Chernobyl and how did we experience the information?, 14:30923 (R;SE;In Swedish)
Findeisen, M., *See* Hentschel, M., 14:32261
Findlay, D.J.S., Photofission assay of 500 litre drums of cemented intermediate level waste. Experimental measurements, 14:31382 (R;GB)
Findling, B., *See* Braeutigam, K.R., 14:31928
Fine, M.E., Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988, 14:31175 (R;US)
Fingas, M., Development of an oil spill simulation model for the Saint-Lawrence River, 14:30304 (R;CA;In French)
Finger, L. W., *See* Hemley, R. J., 14:31370
Finger, S.M., Mini-melter studies of high level nuclear waste form development: effects of added nitrates, carbonates and nitrates/formates in the slurry feed, 14:30506 (RA;US)
Fink, U., *See* Baierl, P., 14:32239
Finley, D. A., *See* Yoshida, T., 14:32579
Finley, N.C., An analysis of the consequences of accidents involving shipments of multiple Type A radioactive material (RAM) packages, 14:30594 (R;US)
The risks and consequences from the transport of low specific activity materials by truck, 14:30451 (R;US)
Finn, J. M., Do steady fast magnetic dynamos exist?, 14:32540 (J;US)
Fischbach, E., *See* Aronson, S., 14:32581
Fischer, D. A., *See* Long, G. G., 14:31890
Fischer, D.R., *See* Trahanovsky, W.S., 14:31536
Fischer, H., Cerebral tumours in adults. A review of results achieved with radiotherapy, 14:32346 (R;DE;In German)
Fischer, H.W., *See* Rinck, P., 14:32229
Fischer, J., *See* Debbe, R., 14:31803
Fischer, R. P., *See* Fliflet, A. W., 14:31889
Fish, R.H., Biomimetic catalysis: Hydroxylation of C_2, C_3, and cycloC_6 hydrocarbons by managanese porphyrin and nonporphyrin catalysts in the presence of monooxygen transfer reagents, 14:30706 (R;US)
Fishbane, P. M., *See* Dover, C. B., 14:32606
Fisher, P.W., Tritium proof-of-principle injector experiment, 14:32948 (J;US)
Fisher, R.M., *See* Radmilovic, V., 14:31239
Fisk, G. A., *See* Gai, H., 14:31543
Fisk, Z., *See* Aronson, M. C., 14:31305
Fitch, W.M., Phylogeny of tRNA sequences provides evidence for ambiguity reduction in the origin of the genetic code, 14:32155 (BA;US)
FitzPatrick, V.F., In situ vitrification - a status of the technology, 14:30514 (RA;US)
Flagan, R.C., *See* Eckert, H., 14:31511
Flaim, T., Forecasting and validating participation rates over time, 14:31015 (RA;US)
Flanagan, G.F., Risk associated with the demilitarization of the United States chemical weapons stockpile, 14:31167 (R;US)
Flanagan, J.M., *See* Cadilla, C.L. Harp, J., 14:32198
Flanders, H.D., *See* Zanner, F.J., 14:31229
Fleck, E.W., *See* Morgan, T.L., 14:32393
Fleck, J. A., Jr., *See* Feit, M. D., 14:32845
Fleet, M. L., *See* Langford, A. A., 14:31679
Fleming, J.O., *See* Lai, M.M.C., 14:32112
Fletcher, T.R., *See* Woodbridge, E.L., 14:31561
Flexser, S., Lithologic composition and variability of the sediments underlying Kesterson Reservoir as interpreted from shallow cores, 14:32417 (R;US)
Fliflet, A. W., Operation of a quasioptical gyrotron with variable mirror separation, 14:31889 (J;US)
Flipot, A.J., EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)
Floss, H.G., *See* Beale, J.M., 14:31507
Flynn, C. P., *See* Yang, M. H., 14:31360
Flynn, C.P., Forces through epitaxially grown interfaces, 14:31184 (R;US)
Flyvbjerg, H., Error estimates on averages of correlated data, 14:33005 (R;DK)
Fobbe, F., *See* Felsenberg, D., 14:32236
Foerster, A., *See* Sandring, K.H., 14:32278
Foerster, C., *See* Baierl, P., 14:32239
Fogel', V.F., *See* Grishanov, B.I., 14:31749
Fogel, D.M., *See* Bowles, C.R., 14:30489
Foldeaki, M., Flux creep in $Y(Gd)Ba_2Cu_3O_{7-\delta}$: Magnetic field dependence, 14:31306 (J;US)
Foley, K. J., The use of TPC's as target region detectors in the MPS, 14:31858 (J;US)
See Cason, N. M., 14:32557
Foley, K.J., *See* Saulys, A.C., 14:31804
Folk, E., *See* Lowson, R.T., 14:30620
Follansbee, P.S., Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking, 14:31216 (R;US)

Fonck, R.J., *See* Levinton, F.M., 14:32882
Fong, R.H., *See* Fish, R.H., 14:30706
Fookes, C.J.R., *See* Stephenson, L.C., 14:30363
Forden, G.E., *See* Strovink, M., 14:31811
Forest, E., Use of various ionization modes for the study of molecules of biological interest, 14:31384 (R;FR;In French)
Vertically integrated simulation tools for self-consistent tracking and analysis, 14:31721 (R;US)
See Neuffer, D., 14:31759
Forrest, S., The dynamical behavior of classifier systems, 14:33001 (R;US)
Forsberg, C.W., *See* Godbee, H.W., 14:30474
Forster, A.C., Structural and ionic requirements for self-cleavage of virusoid RNAs and trans self-cleavage of viroid RNA, 14:32101 (BA;US)
Forsythe, R., *See* Babu, M., 14:30803
Fortier, S., Neutron-hole strengths and core-coupling in /sup 87/Sr via the /sup 88/Sr(/sup 3/He, α)/sup 87/Sr reaction, 14:32664 (R;FR)
Fortner, M. R., *See* Cason, N. M., 14:32557
Fortney, L. R., *See* Cason, N. M., 14:32557
Fossum, A.F., *See* Munson, D.E., 14:30582
Foster, D.E., *See* Yang, J., 14:31155
Fouda, A., *See* Lui, A., 14:31441
Fouda, A.E., Permeation of gas mixtures in cellulose acetate membranes - practical approach to predict the permeation rate CO_2/CH_4 mixture, 14:31457 (J;US)
Fountain, W.F., *See* Takahashi, Y., 14:32680
Fowkes, R.W., *See* Koontz, R.F., 14:31774
Fowkes, W.R., *See* Allen, M.A., 14:31771
Fowler, D.E., *See* Harper, J.B., 14:33021
Fowler, M.M., *See* Wilhelmy, J.B., 14:32681
Fox, A.G., *See* Radmilovic, V., 14:31239
Foy, J.J., *See* Giles, M.S., 14:30621
Frahm, J., *See* Bruhn, H., 14:32264
Fraize, W., *See* Flanagan, G.F., 14:31167
Francis, G.A., Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988, 14:31098 (R;US)
Franconi, E., First wall for NET. Engineering studies, mock up design and manufacturing, 14:32913 (RA;IT)
Frank, A., Algebraic approach to molecular electronic spectra. I. Energy levels, 14:32509 (J;US)
Franke, A., *See* Buhtz, C., 14:32296
Franklin, T.L., *See* Ramirez, J.J., 14:32930
Frantz, R.W., Convergence characteristics of augmented Hessian models for separations, 14:31422 (J;US)
Franz, E.M., *See* Heiser, J.H. III, 14:30454
Franz, F.M., Development and evaluation of polyethylene as solidification agent for low-level waste, 14:30480 (RA;US)
Fredell, J., Arrangement for cooling a nuclear power plant, 14:30870 (TG;US)
Fredrickson, D.R., *See* Chaiko, D.J., 14:31420
Fredrikson, A., *See* Pusch, R., 14:30608
Freeborn, H.P., *See* Feng, X., 14:30522
Freeborn, W.P., *See* Finger, S.M., 14:30506
See Macedo, P.B., 14:30510
Freedman, S.J., LAMPF E645/current status, 14:32546 (R;US)
Freeman, D. L., *See* Xie, J., 14:31485
Freeman, M., Combi-taxi: past, present, and future, 14:31105 (R;ZA)
Freeman, R., *See* Mayberry, M.J., 14:32871
Freeman, S. H., *See* Warren, R. G., 14:32428
Frehaut, J., *See* Dei-Cas, R., 14:31731
Frei, H., *See* Braathen, G., 14:31537
Freier, S.M., *See* Turner, D.H., 14:32092
Freire Ferrero, R., Detected UV variability in the IUE spectra of the Ap-Si star HD 25823, 14:32452 (RA;FR)
Freiser, B.S., *See* Huang, Y., 14:31506
Freitag, G., *See* Freitag, J., 14:32256
Freitag, J., CT diagnosis of rectal tumors, 14:32256 (RA;DD;In German)
See Buhtz, C., 14:32296
See Grasshof, H., 14:32317
Frendewey, D., Different small nuclear ribonucleoprotein particles are involved in different steps of splicing complex formation, 14:32105 (BA;US)
Frentrup, B.D., *See* Brown, K.W., 14:31999
Frere, D., *See* Nawwar, A.M., 14:31663
Frese, K.W., *See* Summers, D.P., 14:31046
Freund, J., Extended x-ray-absorption fine-structure study of copper under high pressure, 14:31256 (J;US)
Frey, L., *See* Wisoff, P.J., 14:31641
Frey, P.A., S-Adenosylmethionine and the mechanism of hydrogen transfer in the lysine 2,3-aminomutase reaction, 14:32135 (BA;US)
Friberg, S.E., Transient liquid crystals in a W/O microemulsion, 14:30290 (R;US)
Frick, E., *See* Furrer, M., 14:30920
Frid, W., Behavior of a corium jet in high pressure melt ejection from a reactor pressure vessel, 14:30841 (R;SE)
Fridman, A.M., *See* Afanasiev, V.L., 14:32455
Fried, B. D., *See* Hinkel-Lipsker, D. E., 14:32537
Friedman, A., *See* Gover, A., 14:31648
Friedman, A.A., Methane from partially digested sewage sludge. Final report, 14:30651 (R;US)
Friend, C.M., *See* Roberts, J.T., 14:31514
Frind, E.O., *See* Palmer, C.D., 14:30956
Frittelli, L., Is the objective health detriment an useful concept for evaluating the exposure of a population to ionizing radiation?, 14:32378 (RA;AT)
Fritz, J.S., *See* Plantz, M.R., 14:31400
Fritz, O.G., *See* Paul, R., 14:31477
Frotscher, H., *See* Kraemer, R., 14:30477
Froyen, S., Electronic structure of [110] Si-Ge thin-layer superlattices, 14:31358 (J;US)
Fu, C.Y., *See* McWilliams, B.M., 14:31345
Fu, Z., Self-desulphurating characteristics of high sulfur oil shale in fluidized bed combustor, 14:30399 (RA;CN)
Fu, Z.J., *See* Cantale, C., 14:30515
Fucci, F., *See* Carotenuto, A., 14:30937
Fuehrer, M.E., *See* James, B.J., 14:32939
See Nolen, R.L. Jr., 14:32938
Fuerniss, B., *See* Braeutigam, K.R., 14:31928
Fuhrmann, K., Au II in IUE spectra of chemically peculiar stars, 14:32450 (RA;FR)
Fujii, K., *See* Aston, D., 14:32549, 14:32551, 14:32558
Fujii-e, Y., Safety and environmental aspect of fusion, 14:32917 (RA;BR)
Fujita, H., *See* Hayashi, M., 14:30364
See Sugiyama, Y., 14:32667
Fujita, S., *See* Yuan, H.S.H., 14:32355
Fujita, Y., *See* Matsubara, T., 14:30864
See Yamamoto, M., 14:30491
Fukushima, E., *See* Givler, R.C., 14:31657
Fukuzawa, H., *See* Ozeki, H., 14:32158
Fulcher, J.N., Development and validation of a test method for acrylonitrile emissions, 14:31951 (R;US)
Fuller, K.E., Customer segmentation, 14:31019 (RA;US)
Fulton, B.R., *See* Fifield, L.K., 14:32662
Fulton, J.L., *See* Smith, R.D., 14:31452
Fultz, B., *See* Hamdeh, H. H., 14:31251
Funke, T., Verification of constitutive equations for application at 850/sup 0/C, using the internal stress concept, 14:31214 (R;DE;In German)
Furman, V.I., *See* Lomachenkov, I.A., 14:32730
Furrer, M., Iodine severe accident behaviour code IMPAIR 2, 14:30920 (R;CH)
Futamase, T., *See* Maeda, K., 14:32467

G

Gabella, W.E., Beam dynamics with the Hamilton-Jacobi equation, 14:31728 (R;US)
Gabriel, T.A., CALOR89: The code system for calorimeter analysis and design, 14:31808 (R;US)

Detectors for the Superconducting Super Collider, design concepts, and simulation, 14:31807 (R;US)
Detectors for the superconducting super collider, design concepts, and simulation, 14:31849 (R;US)
See Santoro, R.T., 14:33028
Gaddy, J.L., *See* Prieto, S., 14:30662
Gaevenko, A.Yu., *See* Kumshaev, S.B., 14:31820
Gaffney, J.S., *See* Tanner, R.L., 14:31978
Gai, H., A classical trajectory study of intramolecular vibrational relaxation and unimolecular decomposition in methyl hydroperoxide, 14:31543 (J;US)
Gaillard, B., *See* Calmels, P., 14:30557
Gaillard, M.K., Symmetry breaking: The standard model and superstrings, 14:32618 (R;US)
Gaisser, T. K., *See* Barr, G., 14:32471
Galanti, P., *See* DeLong, T., 14:30867
Gale, L.G., *See* Berglund, G.R., 14:30540
Galeriu, D., Competing mechanisms in helium ions induced fission. The role of shell effects, 14:32717 (R;RO;In Romanian)
Gales, S., *See* Fortier, S., 14:32664
Galindo, A.C., Pre-cambrian geochronology in Rio Grande do Norte, Brazil, 14:32416 (R;BR;In Portuguese)
Gall, B.L., *See* Noll, L.A., 14:30292
Gall, J.G., *See* Epstein, L.M., 14:32102
Gallagher, B.D., *See* Dutta, S., 14:31340
Gallegos, G.F., *See* Huang, J.S., 14:31240
Gallina, M., 3-D Montecarlo analysis of the NET shielding system, 14:32909 (RA;IT)
See Anzidei, L., 14:32910
Galvao, R.M.O., *See* Vannucci, A., 14:32872
Galzerani, J.C., *See* Oliveira, J.B.B., 14:31208
Gamberini, R.J., *See* Williams, L.C., 14:32988
Gammel, G.M., *See* Kamperschroer, J.H., 14:32928
See Levinton, F.M., 14:32882
Gangwal, S.K., Multicycle testing of zinc ferrite, 14:30250 (R;US)
Gann, V.V., *See* Volobuev, A.V., 14:31211
Gannon, A.J., *See* Alfredson, P.G., 14:30324
Gannon, J., Using control states for parallelism extraction. Final report, 1 March 1987-30 June 1988, 14:32979 (R;US)
Garabedian, P. R., Design of a large helical system for magnetic fusion experiments, 14:32934 (J;US)
Garbincius, P. H., *See* Hearty, C., 14:32577
Garcia, D., *See* Menegazzo, B.A., 14:31280
Garcia, J.C.M., Dynamical breakdown of chiral symmetry in vectorial theories: QED and QCD, 14:32628 (R;BR;In Portuguese)
Garcon, M., *See* Beise, E. J., 14:32658
Gard, J.R., *See* Risa, R., 14:31689
Gardner, T.W., *See* Jorgensen, D.W., 14:32025
Garg, M.L., *See* Singh, S., 14:32494
Garin, J.L., Use of overlapped reflection for determining the retained austenite by X-ray diffraction, 14:32797 (R;BR;In Spanish)
Garner, J., Comparison of optimization methods for electronic-structure calculations, 14:32813 (J;US)
Garofalini, S. H., *See* Feuston, B. P., 14:31354
Garoff, S., The effects of substrate roughness on ultrathin water films, 14:31549 (J;US)
Garrett, D.L., PVREG - A photovoltaic voltage regulation investigation tool: Program reference manual, 14:30748 (R;US)
PVREG – a photovoltaic voltage regulation investigation tool: PVREG user's manual, 14:30747 (R;US)
Garrido, L., *See* Ackerman, J.L., 14:31863
Garrison, J.A., Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988, 14:31988 (R;US)
Gartrell, C.F., Expert-system approach to large space-systems control. Technical report, September 1987-October 1988, 14:31891 (R;US)
Garwood, R.W., *See* Mettlach, T.R., 14:31898
Gary, J.H., Ahead of our time, 14:30411 (RA;CN)
Garzon, F. H., *See* Aronson, M. C., 14:31305
Gasparini, G., *See* Cecille, L., 14:30456
Gasparotto, M., *See* Andreani, R., 14:32908
See Migliori, S., 14:32906
See Pizzuto, A., 14:32911
Gathers, G.R., *See* Osher, J.E., 14:31623
Gatrone, R.C., *See* Nash, K.L., 14:31571
Gatzke, M., *See* Bonin, K. D., 14:32520
Gausserand, F., *See* Menanteau, B.P., 14:32277
Gautreau-Daigle, H., *See* Daigle, J.-Y., 14:30276
Gavrilyuk, V.I., Position-sensitive detector for local plane of the beta-spectrometer, 14:31822 (R;SU;In Russian)
Gavron, A., *See* Byrd, R.C., 14:31824
See Wilhelmy, J.B., 14:32681
Gawlak, M., Batch autoclave testing of subbituminous coals of Alberta. Carbon monoxide/steam and dispersed catalyst process, 14:30242 (R;CA)
Gaylord, R. H., *See* Kilcoyne, A. L. D., 14:31259
Ge Qingren, Solving the non-isothermal kinetic curves of gas-solid reactions by non-linear fitting method, 14:31465 (R;CN;In Chinese)
Ge, L., *See* Benner, S.A., 14:32084
Gearhart, R., *See* Rolfe, J., 14:31779
Geballe, T. H., *See* Bridges, F., 14:31308
See Dickinson, P. H., 14:31296
Geballe, T.H., Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988, 14:31266 (R;US)
Gee, J.M., *See* Hargis, P.J. Jr., 14:31343
Gehring, K.B., *See* Williams, P., 14:32210
Gelb, J. M., *See* Rosen, S. P., 14:32470
Gelfuso, M.V., *See* Menegazzo, B.A., 14:31280
Geller, A.S., Application of a mixture theory model to the dispersal of solid by a high-pressure gas, 14:31896 (R;US)
Gellerich, I., Hereditary myopathies in patients free of signs as evidenced by CT, 14:32308 (RA;DD;In German)
See Grasshof, H., 14:32317
Gellings, C., Integrated value-based planning, 14:31008 (RA;US)
Genfa, Z., Fluorometric measurement of aqueous ammonium ion in a flow injection system, 14:31405 (J;US)
Geng, C. Q., *See* Liu, J., 14:32614
Gennaro, M.S., Proceedings: 1986 workshop on advanced high-strength materials, 14:30821 (R;US)
Genov, H., Computed tomography of the brain after posttraumatic changes, 14:32245 (RA;DD)
Gentier, S., *See* Long, J.C.S., 14:32433
Gentile, C.A. Jr., Tritium detectors employed at the Tokamak Fusion Test Reactor, 14:32950 (J;US)
Geoffrey, J., *See* Glass, R.E., 14:31611
George, J.L., *See* Martz, D.E., 14:31063
George, M.V., *See* Ramaiah, D., 14:31555
Georgescu, S.A., Some peculiar facts of the CT diagnosis of xanthogranulomatous pyelonephritis, 14:32291 (RA;DD)
See Pana, I., 14:32342
Gerber, A.S., *See* Doudna, J.A., 14:32096
Gerberich, W.W., *See* Lii, M., 14:31246
Gerbi, S.A., Evolution of eukaryotic rRNA: constraints imposed by RNA interactions, 14:32150 (BA;US)
Gerding, T.J., *See* Bates, J.K., 14:30611
German, U., *See* Ben-Shachar, B., 14:31840
Gerschel, C., Contribution of the final state interactions to the suppression of the J/PSI meson produced in high-energy nucleus-nucleus collisions, 14:32732 (R;FR)
Gerstein, B.C., *See* Chu, P.J., 14:31518
See Trahanovsky, W.S., 14:31536
Gerstl, S.A.W., *See* Zardecki, A., 14:31636
Gerward, L., Bulk moduli and high-pressure phases of the uranium rocksalt structure compounds. Pt. 1. The monochalcogenides, 14:31326 (R;DK)
Bulk moduli and high-pressure phases of ThX compounds. Pt. 1. The thorium monopnictides, 14:31328 (R;DK)
See Staun Olsen, J., 14:31327, 14:31329
Gesteland, R.F., *See* Weiss, R.B., 14:32148
Geutjes, A.J., *See* Matteman, J.L., 14:30487
Gewiese, B., Effect of substances shortening the relaxation time on /sup 31/P and /sup 13/C-NMR spectroscopy, 14:32269 (RA;DD;In German)
See Stiller, D., 14:32270
Geyer, J., *See* Rotte, K.H., 14:32319

Ghan, S.J., Simplified climate models: Rationale and design, 14:31912 (R;US)
See Mettlach, T.R., 14:31898
Ghandhi, S.K., *See* Borrego, J.M., 14:30707
Ghendrih, P., Effect of pump limiter throat on pumping efficiency, 14:32860 (R;FR)
See Grosman, A., 14:32861
Gheorghiu, E., Study of fission gases behaviour in the Romanian UO/sub 2/, 14:30435 (R;RO;In Romanian)
Gherini, S.A., Chemical data for predictinng the fate of organic compounds in water: Volume 1, Technical basis: Final report, 14:32035 (R;US)
Ghiglia, D. C., *See* Sanford, T. W. L., 14:32888
Ghiglia, D.C., Direct phase estimation from phase differences using fast elliptic PDE [partial differential equation] solvers, 14:31607 (R;US)
Two-dimensional phase correction of synthetic aperture radar imagery, 14:31608 (R;US)
See Stygar, W.A., 14:31873
Ghoniem, N. M., Stochastic theory of diffusional planar-atomic clustering and its application to dislocation loops, 14:32810 (J;US)
Ghosh, D., Development of tough ceramics. Final report, 14:31320 (R;CA)
Ghumman, B.S., Inelastic scattering of gamma rays from K-shell electrons of tantalum, 14:32496 (RA;BR)
Giambuzzi, S., *See* Glass, R.E., 14:31611
Giammona, D.A., *See* Alber, T.C., 14:32139
Giannousis, P.P., *See* Bartlett, P.A., 14:32087
Gibbard, B. G., *See* Abe, K., 14:32569
Gibbs, G.E., *See* Hedley, W.H., 14:32951
Gibney, M. C., *See* Anjos, J. C., 14:32571, 14:32572
Gibson, B.W., *See* Higaki, J.N., 14:32140
Gidal, G., Resonance formation in photon-photon collisions, 14:32554 (J;US)
Giddings, J.C., *See* Jones, H.K., 14:31410
Gielen, J., *See* Baert, A.L., 14:32328
Giergiel, J., Surface plasmon polariton enhancement of Raman scattering in Kretschmann geometry, 14:31462 (J;US)
Giese, J. P., *See* Schulz, M., 14:32516
Gieselmann, M.J., Physico-chemical properties of supported and unsupported γ-Al_2O_3 and TiO_2 ceramic membranes, 14:31432 (J;US)
Giewank, A.K., *See* Cullick, A.S., 14:30294
Gilbert, E.R., *See* Sanders, T.L., 14:30580
Gilbert, J.D., *See* Stencil, J.R., 14:32953
Gilbert, V.P., Proposed technique for surface dynamics measurements at high pressure, 14:31492 (J;US)
Gilbert, W., Exon theory of genes, 14:32168 (BA;US)
Gilbert, W.S., Training of LBL-SSC model dipole magnets at 1.8 K, 14:31765 (R;US)
Giles, G.E., *See* Wendel, M.W., 14:31597
Giles, M.S., Environmental survey at Lucas Heights Research Laboratories, 1985, 14:30621 (R;AU)
Gill, J.T., Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)
Gillie, R.D., Beaufort Sea artificial island erosion data, 14:30303 (R;CA)
Gilman, R., *See* Leitch, M. J., 14:32657
Ginocchio, J. N., *See* Wenes, G., 14:32743
Giorgi, A. L., *See* Heffner, R. H., 14:31252
Givler, R.C., Two-phase flow measurements by nuclear magnetic resonance imaging, 14:31657 (R;US)
Gjersvik, T.B., *See* Kvitvang, A., 14:31690
Gladden, J.B., Evaluation of stream biological communities in nonthermal reaches of Four Mile Creek: Revision 1, 14:32052 (R;US)
Gladden, J.R., Development of fast-burn combustion with elevated coolant temperatures for natural gas engines. Annual report, May 1987-April 1988, 14:31165 (R;US)
Glaeser, M., Radiometric weighing devices. Part 1 and 2. Fundamentals, design, and applications, 14:30648 (R;DD;In German)
Glanzman, T., *See* Briggs, D., 14:31853
Glascock, J., *See* Edwards, R. Jr., 14:30507
Glasfeld, A., *See* Benner, S.A., 14:32084
Glass, H. D., *See* Yoshida, T., 14:32579
Glass, R.E., Design basis for resistance to shock and vibration, 14:30599 (R;US)
Impact testing and analysis for structural code benchmarking, 14:31612 (R;US)
Standard thermal problem set, 14:31611 (R;US)
Glassell, J.T., Evaluation of the IBM token-ring network via the proposed standard wiring plan, 14:33008 (R;US)
Glasser, F.P., Characterization of radioactive waste forms. Progress report for 1986 Volume 1, 14:30553 (R;FR)
Glassman, I., Fuels combustion research. Final technical report, 1 October 1985-30 September 1988, 14:31579 (R;US)
Glick, J., *See* DiBella, F., 14:31137
Glick, M. R., Molecular absorption measurements by FT/UV-Vis spectrometry, 14:31883 (J;US)
Glikson, M., High resolution transmission electron microscopy (TEM) in the study of oil shales, 14:30378 (RA;CN)
Glockshuber, R., *See* Plueckthun, A., 14:32090
Glowienka, J.C., *See* Langley, R.A., 14:32899
Gmitter, T.J., *See* Cox, H.M., 14:31231
Gmuca, S., Methods for the calculation of neutron induced reactions, 14:32714 (R;XA)
Gnidak, N.L., *See* Kirilyuk, A.L., 14:32653
Go, M., Protein architecture and the origin of introns, 14:32170 (BA;US)
Goble, R. L., The reaction $\gamma\gamma \to \pi\pi$ at low energy, 14:32608 (J;US)
Godbee, H.W., Source-term development for commercial low-level radioactive waste, 14:30474 (RA;US)
Godfrey, S., Summary of the hybrids and exotics sessions, 14:32568 (J;US)
Goebel, C. J., Comment on "Resolution of causality violation in the classical radiation reaction", 14:32853 (J;US)
Goebel, K., Long-term experience in mixed field radiation monitoring, 14:32770 (RA;AT)
Goergner, D., *See* Beyermann, M., 14:30575
Goff, D.A., *See* Barkigia, K.M., 14:32185
Gold, H., *See* Lawrence, N., 14:32099
Goldberg, M., *See* Bortoletto, D., 14:32573
Golden, T., *See* Wang, J., 14:31552
Golder, W., Importance of CT and MR in extracorporeal cholelithotripsy, 14:32226 (RA;DD;In German)
Goldhaber, M., After-dinner talk—Reminiscences of a particle physicist, 14:32594 (J;US)
Goldman, A. M., *See* Kim, D. H., 14:31310
Goldman, J. H., *See* Boehnlein, A., 14:32564
Goldman, T., *See* Maltman, K., 14:32599
Goldsmith, S., *See* Moreno, J. C., 14:32895
Goldstein, J., *See* White, A.L., 14:31039
Goldstein, M. L., *See* Hoshino, M., 14:32465
Goldston, R.J., *See* Arunasalam, V., 14:32881
Golikov, V.Y., *See* Buldakov, L.A., 14:30912
Goloborod'ko, V.Ya., Angular distribution of alpha particle flux on the first wall of a tokamak, 14:32879 (R;SU;In Russian)
Goloviznin, V.V., Polarized photons from quark-gluon plasma, 14:32587 (R;SU)
Golshan-Shirazi, S., Experimental characterization of the elution profiles of high concentration chromatographic bands using the analytical solution of the ideal model, 14:31406 (J;US)
Goltermann, J., *See* Bogun, K.R., 14:32251
Golubev, A.I., On two variants of solving the eigenvalue problem for a system of second-order differential equations in the method of many-dimensional angular coulomb functions, 14:32504 (RA;SU;In Russian)
Golubev, V.A., *See* Anikejchik, A.M., 14:31743
Golutvin, I.A., Methods and systems for diagnostics of electron bunches by synchrotron radiation in infrared range, 14:31750 (R;SU;In Russian)
Gomez, J.J., *See* Levi, M., 14:31777
Gompper, G., Theory of the critical X-ray and neutron scattering at surfaces, 14:32798 (R;DE;In German)
Goncharov, V.N., Software for the Odrenok microcomputer. FORTRAN-1900, 14:32998 (R;SU;In Russian)
Goncher, G.M., Enhanced photochemistry on metal surfaces, 14:31234 (BA;US)

Gonzales, H., State uses of Exxon and Stripper Well oil overcharge funds: Status report No. 3, 14:30306 (R;US)
Gonzalez, C.F., *See* Garin, J.L., 14:32797
Gonzalez, R., Diffusion of tritons, deuterons, and protons in $LiNbO_3$ crystals, 14:31366 (J;US)
See Robinson, W.A., 14:32218
Gonzalez-Doncel, G., *See* Whalen, R.T., 14:31241
Goo, J., *See* Cason, N. M., 14:32557
Goodenough, J.B., *See* James, A.C.W.P., 14:31481
Goodman, D.W., *See* Berlowitz, P.J., 14:31515
Goodman, M., Globins: a case study in molecular phylogeny, 14:32166 (BA;US)
Goodman, W.L., Development of a magnetic coating for gas pipe detection. Final report, May 1987-June 1988, 14:30322 (R;US)
Goodwin, S.M., *See* Bryce, R.W., 14:31967
Gopaliengar, R., Effects of scratched surfaces on passivation, anodic dissolution and hydrogen evolution kinetics, 14:31237 (BA;US)
Gorbics, M. S., *See* Meyer, W. T., 14:33014
Gordon, A.M.P.L., *See* Hiromoto, G., 14:30624
Gordon, B.M., *See* Jones, K.W., 14:31463
Gordon, C.L., High-pressure Ar-Xe waveguide lasers with microwave discharge excitation, 14:31638 (BA;US)
Gordon, J., *See* Naudet, C., 14:32659
Gorenstein, M.I., *See* Kaempfer, B., 14:32704
Gorenstejn, M.I., *See* Bugaev, K.A., 14:32733
Goretta, K.C., *See* Wu, W., 14:31269
Gorre, H., *See* Schulz, H., 14:30264
Gosnell, T.R., *See* Mukherjee, P., 14:31637
Gott, J.M., *See* Shub, D.A., 14:32205
Gottschalk, E., *See* Hartouni, E. P., 14:32561
Gould, J.L., Developments in environmental monitoring, 14:30882 (RA;AT)
Goulding, R.H., *See* Langley, R.A., 14:32899
Gouv@/re@, Vortices in the classical two-dimensional anisotropic Heisenberg model, 14:32811 (J;US)
Govaerts, P., Summary of the impact of the Chernobyl release on the Belgian territory, 14:32013 (RA;AT)
Gover, A., Uses of very high-power free-electron lasers based on electrostatic accelerators, 14:31648 (BA;US)
Govind, R., *See* Ilias, S., 14:31435
See Mohan, K., 14:31490
Goyer, N., Air quality and ventilation in three office buildings, 14:31058 (R;CA;In French)
Grab, C., *See* Mir, R., 14:31852
Grabowski, P.J., *See* Sharp, P.A., 14:32104
Graebner, H., *See* Kraemer, R., 14:30477
Graham, R.A., Issues in shock-induced solid state chemistry, 14:31475 (R;US)
See Moore, L.M., 14:31892
See Morosin, B., 14:30968
Granato, A.V., Acoustic studies of solids, 14:32785 (R;US)
Grant, D.C., *See* Smeltzer, E.E., 14:30466
Grant, N.R., *See* Feldman, M.J., 14:30438
Grass, F., *See* Boeck, H., 14:30917
Grasshof, H., CT in relapsing dislocation of the shoulder joint, 14:32317 (RA;DD;In German)
Grattarola, M., *See* Franconi, E., 14:32913
Grauby, A., Role de la radioecologie dans l'evaluation de l'impact des activites nucleaires dans l'environnement, 14:30881 (RA;IL)
Graves, F.C., *See* Read, J., 14:31020
Gray, E.R., *See* Cooke, D.W., 14:31333
Gray, G., *See* Beyer, J.M., 14:30682
Gray, G.A., *See* Hansel, H.C., 14:30692
See Lucchetti, G.L., 14:30691
Gray, J., The Argonne low level ^{14}C counting system, 14:31905 (R;US)
Gray, K. E., *See* Kim, D. H., 14:31310
Gray, K. J., Simulated response of multilayer x-ray reflectors to damaging fluxes, 14:31238 (J;US)
Gray, M., *See* Pusch, R., 14:30608
Gray, R., *See* Yoshida, T., 14:32579
Graycar, T.P., *See* Wells, J.A., 14:32144
Graziani, G., *See* Crabol, B., 14:31981
Grebenyuk, S.V., Ferritor isolator for RF power supply system of a linear accelerator, 14:31745 (RA;SU;In Russian)
Grebnev, A.V., *See* Kirilyuk, A.L., 14:32653
Greco, J.M., *See* Stencil, J.R., 14:32953
Green, D., $p\bar{p}$ collider physics, 14:32544 (R;US)
Green, J., *See* Park, I. H., 14:32570
Green, J.A., *See* Green, J.B., 14:30312
Green, J.B., Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Detailed separation and analysis of basic compounds, 14:30312 (R;US)
Green, M.A., A large superconducting detector magnet without an iron return path, 14:31825 (R;US)
Cryogenic techniques for large superconducting magnets in space, 14:31599 (R;US)
Passive superconductor: A viable method of controlling magnetization multipoles in the SSC dipole, 14:31766 (R;US)
Green, M.I., *See* Keller, R., 14:31761
Green, P.J., Evaluation of waveform digitizer systems and components in accordance with IEEE waveform digitizer standards, 14:31676 (R;US)
Greenberg, C.H., Free-ranging dogs and cats on the Oak Ridge Reservation: Situation and solution, 14:32409 (R;US)
Greenblatt, M., *See* Wang, E., 14:31378
Greene, D.P., Time-resolved absorption spectroscopy of Kr/sub 2/F(4/sup 2/T), 14:31642 (BA;US)
See McCown, A.W., 14:31646
Greene, E. F., *See* Ha, J. S., 14:31355
Greene, G.A., *See* Powers, D.A., 14:30921
Greenfield, P.F., *See* Zhu, S., 14:30421
Greenwoll, J.I., *See* Reed, R.P., 14:31865
Gregory, D.L., *See* Yoshimura, H.R., 14:30602
Gregory, J. J., Thermal measurements in large pool fires, 14:31683 (J;US)
Gregory, J.C., *See* Takahashi, Y., 14:32680
Greinacher, C.F.C., System configuration and functional characteristics of the structured Siemens picture archiving and communication systems (PACS), 14:32322 (RA;DD;In German)
Grek, B., *See* Arunasalam, V., 14:32881
Grennfelt, P., *See* Calander, K., 14:31926
Gribble, R.J., *See* Rej, D.J., 14:32923
Griem, H. R., *See* Moreno, J. C., 14:32895
Griesbach, O.A., Operational experience with the DATS sampler during the Canadian tritium modeling experiment, 14:32961 (J;US)
See Stencil, J.R., 14:32953
Griesmeyer, J.M., Advanced handling technology project and implications for cask design, 14:30595 (R;US)
Griest, W.H., Evaluation of micellar electrokinetic capillary chromatography for the separation and detection of normal and modified deoxyribonucleosides and deoxyribonucleotides, 14:31444 (J;US)
Grimaas, U., Biological and radioecological investigations at Ringhals nuclear power plant 1968-1987, 14:30887 (R;SE;In Swedish)
Grimmig, M., *See* Andersen, N.B., 14:31143
Grimsditch, M., *See* Sharma, R. P., 14:31349
Grisham, L.R., *See* Kamperschroer, J.H., 14:32928
Grishanov, B.I., Study on pulse characteristics of belt magnetic circuits made of thin transformer steel, 14:31749 (R;SU;In Russian)
Grivell, L.A., *See* Tabak, H.F., 14:32097
Grizzle, P.L., *See* Green, J.B., 14:30312
Grobovschek, M., *See* Rahim, H., 14:32388
Groenemeyer, D.H., *See* Seibel, R.M., 14:32304
Grohmann, K., Dilute acid pretreatment of biomass, 14:30711 (RA;US)
Synthesis of an affinity gel for purification of beta-glucosidases, 14:30718 (RA;US)
See Bynum, M.T., 14:30712
See Himmel, M.E., 14:30714
See Lastick, S., 14:30669
See Mohagheghi, A., 14:30723
See Spindler, D.D., 14:30667
Grosgogeat, E., *See* Noble, R.D., 14:31426
Grosman, A., Role of the pump limiter throat-ergodic divertor effect on edge plasma, 14:32861 (R;FR)
See Ghendrih, P., 14:32860

Grosse-Wiesmann, P., *See* Briggs, D., 14:31853
Grossi, G., *See* Donato, A., 14:30461
Grossman, L., *See* Caron, P.R., 14:32201, 14:32202
Grossmann, I., *See* Markwardt, J., 14:32315
See Stuerzer, I., 14:32311, 14:32314
Grove-Nielsen, E., Flap-by-flap testing for materials fatigue in Aerostar 7.5 m wind-turbine blades, 14:30788 (R;DK;In Danish)
Grover, M., Positron emission computed tomography, 14:32354 (BA;US)
Groves, J.T., *See* Czernuszewicz, R.S., 14:31499
Grudzevich, O.T., Consistent systematics of energy-level density of nuclei in the range off $40 \leq A \leq 150$, 14:32725 (RA;SU;In Russian)
Gruender, W., Effectivity of perfusion solutions for kidney preservation assessed by means of /sup 31/P-NMR spectroscopy, 14:32271 (RA;DD;In German)
See Buchali, K., 14:32265
See Dannhauer, K.H., 14:32268
See Ellermann, J., 14:32266
See Keller, T., 14:32267
Gruetzmacher, K.M., Transportation of tritiated waste from fusion facilities, 14:32940 (J;US)
See Casey, M.A., 14:32941
See Sherman, R.H., 14:32963
Gschneidner, K. A., Jr., *See* Herchenroeder, J. W., 14:31254
Gu Weizu, Systematic study of distribution characters of infiltration parameters in an experimental basin by nuclear methods, 14:31993 (RA;XA)
Gu, C., *See* Arko, A.J., 14:31393
Guan, M., *See* Lu, S., 14:30377
Gudkov, V.P., *See* Bunakov, V.E., 14:32723
Guenther, R.W., *See* Bohndorf, K., 14:32316
Guerra, F., *See* Logan, R., 14:31215
Guerrier-Takada, C., *See* Lawrence, N., 14:32099
Guffey, F.D., *See* Cha, C.Y., 14:30370
Guidi, G., *See* Cantale, C., 14:30515
Guilford, S.J., *See* Fee, E.J., 14:32028
Guimaraes, L., *See* Martins, R., 14:31387
Guiochon, G., *See* Golshan-Shirazi, S., 14:31406
Gul'ko, G.M., *See* Koval', G.N., 14:32763
Gundappa, M., *See* Campbell, D. S., 14:31661
Gunji, S., *See* Kamae, T., 14:31795
Gunter, B.J., Health-hazard evaluation determination report No. 76-6-294, J. A. Devine, D.D.S., Cheyenne, Wyoming, 14:31963 (R;US)
Guo, S., Maoming and Huadian oil shale retorting using solid heat carrier, 14:30354 (RA;CN)
Supercritical extraction of Chinese oil shales, 14:30338 (RA;CN)
Gupta, H.C., Importance biasing for 1-D deep-penetration problem by Monte Carlo, 14:32747 (R;IN)
Gupta, M. Paris-11 Univ., *See* Gupta, R.P., 14:31268
Gupta, R.P., Electronic structure and chemical bond of high Tc superconductors, 14:31268 (R;FR;In French)
Gupta, S., Vapor-liquid equilibria in fluids of two-center Lennard-Jones molecules, 14:31546 (J;US)
Guram, M.S., Development of critical life stage assays: Teratogenic effects of ash basin effluent components on freshwater fish, gambusia affinis and daphnia: Progress report, 21 May 1988–1 June 1989, 14:30275 (R;US)
Gurley, R.N., Hanford Waste Vitrification Plant project: an overview, 14:30499 (RA;US)
Gurnett, D.A., Micron-sized-particle impacts detected near Uranus by the Voyager 2 plasma-wave instrument. Progress report for period ending 1986, 14:32442 (R;US)
See Persoon, A.M., 14:32477
Gursky, S., Trends in development of computerized tomography and future applicability, 14:32232 (RA;DD;In German)
Gusev, N.G., *See* Buldakov, L.A., 14:30912
Gustafsson, I., *See* Bergenlid, U., 14:30834
Gustavsson, K., *See* Calander, K., 14:31926
Gusynin, V.P., *See* Miranskij, V.A., 14:32617
Gutbrod, H.H., *See* Albrecht, R., 14:32706
Gwinn, K.W., *See* Glass, R.E., 14:30599
Gyapong, G.J., *See* Fewell, M.P., 14:32677
See Lim, C.S., 14:32679
Gyngell, M.L., *See* Bruhn, H., 14:32264

H

Ha, J. S., Observation of phase transitions on the (111) and (100) surfaces of Si near 1000 K with He atom diffraction, 14:31355 (J;US)
Haahr Joergensen, K., *See* Christiansen, H., 14:32002
Haan, S. W., Onset of nonlinear saturation for Rayleigh-Taylor growth in the presence of a full spectrum of modes, 14:32894 (J;US)
Haas, F., Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)
Haas, F. 5Strasboug-1 Un, C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels, 14:32655 (R;FR)
Haase, A., Fast-scan magnetic resonance imaging, 14:32228 (RA;DD)
Haase, D.G., *See* Kingon, A.I., 14:31278
Habing, H.J., *See* Lindqvist, M., 14:32460
Hachey, L.T., *See* Parker, J.C., 14:30974
See Tharp, W.H., 14:30973
Hacke, J., *See* Borchardt, D., 14:30893
Hackenburg, R.W., *See* Saulys, A.C., 14:31804
Hacker, H., *See* Rienmueller, R., 14:32279
Haddad, W., *See* Cullen, D., 14:31626
Haddow, G., *See* Laun, J., 14:31026
Haegg, C., *See* Bergman, C., 14:30640
See Ericsson, G., 14:30641
Haehnel, H., CT studies in planning backbone operation, 14:32310 (RA;DD;In German)
Haenicke, W., *See* Bruhn, H., 14:32264
Hafich, M. J., *See* Patel, D., 14:31364
Hagaman, E.W., Local structure evaluation in solid organophosphorus compound by double cross polarization carbon-13 nuclear magnetic resonance spectroscopy, 14:31521 (J;US)
Hagan, R. C., *See* Warren, R. G., 14:32428
Hagelstein, P.L., Theoretical studies and algorithm development for x-ray lasers: Final report, June 15, 1988–February 15, 1989, 14:31634 (R;US)
Hagen, C. R., Comment on a paper by Rindani and Sivakumar, 14:32607 (J;US)
Hagen, G., Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)
Hagenauer, R.C., *See* Cooley, J.N., 14:30625
Haggag, F.M., *See* Nanstad, R.K., 14:31183
Hagopian, V., *See* Boehnlein, A., 14:32564
Hahn, E.F., *See* Scott, B.R., 14:30909
Hahn, K., *See* Judd, D.L., 14:32924
Haigh, C.P., CEGB experience in immobilizing radioactive resins, sludges, and related wastes, 14:30479 (RA;US)
Haighton, A.P., *See* Haigh, C.P., 14:30479
Haik, C.C., *See* Menegazzo, B.A., 14:31280
Hailey, C.E., Coupling of the boundary element method with an integral momentum boundary-layer technique to calculate forces and moments on three-dimensional bodies, 14:31603 (R;US)
Hainfeld, J.F., Antibody-gold cluster conjugates, 14:32177 (P;US)
Hajek, M., Current status of in vivo NMR spectroscopy in medicine, 14:32260 (RA;DD)
Halbach, K., *See* Hopkins, D.B., 14:31697
Halbleib, J. A., *See* Sanford, T. W. L., 14:32888
Halbleib, J.A., *See* Stygar, W.A., 14:31873
Halbritter, G., *See* Braeutigam, K.R., 14:31928
Halford, V.E., *See* Berglund, G.R., 14:30540
Hall, D.S., *See* Bryant, D.A., 14:32479
Hall, I.W., Kinetics of the reaction of NO_3 with HO_2, 14:31512 (J;US)
Hall, T.C., *See* Marsh, L.E., 14:32109
Hallard, K., *See* Fee, E.J., 14:32028
Hallenstein, C., *See* Chandra, S., 14:30453
Halley, J. W., *See* Hautman, J., 14:31483
Hallman, T., *See* Naudet, C., 14:32659
Halman, L., *See* Srp, A., 14:32255
Halpern, H., *See* Auer, I. P., 14:32575
Hamaguchi, S., Anomalous transport arising from nonlinear resistive pressure-driven modes in a plasma, 14:32891 (J;US)

Hamann Spendler, F., Use of hemicellulose hydrolate in the production of fatty acids, 14:32175 (R;DK;In Danish)
Hamarneh, Y.M., Oil shale in central Jordan, 14:30327 (RA;CN)
Hamdeh, H. H., Mössbauer spectrometry study of the hyperfine fields and electronic structure of Fe-Co alloys, 14:31251 (J;US)
Hamel, H.J.E., Cold forming degree and heat treatment on Wste 26 dished head, 14:30868 (R;BR)
Hamil, R.A., *See* Denison, G.J., 14:32931
See Zutavern, F.J., 14:31672
Hamm, B., MR diagnosis of the liver - state and prospect, 14:32221 (RA;DD;In German)
Hamm, K.D., *See* Kachel, R., 14:32333
Hammer, H., *See* Boeck, H., 14:30917
Hammerling, P., *See* Erber, T., 14:32844
Hamzaoui, C., *See* Campa, A., 14:32613
Han, B.M., Tuning magnet power supply, 14:31754 (R;US)
Han, W., *See* Guo, S., 14:30338, 14:30354
Han, Z., Properties of shale ash (taken from the boiling furnace) Portland cement, 14:30405 (RA;CN)
See Guo, S., 14:30354
See Tian, G., 14:30404, 14:30406
Handegord, G.O., The development of services for the transfer of technical information on building, 14:33020 (R;CA)
Haney, R.L., *See* Mettlach, T.R., 14:31898
Hannum, D.W., Characteristics of select glass tube preconcentrators used with an ion mobility spectrometer, 14:31871 (R;US)
Hansel, H.C., Use of diagnostic bones to identify and estimate original lengths of ingested prey fishes, 14:30692 (RA;US)
See Poe, T.P., 14:30680
See Vigg, S., 14:30681
Hanselman, W.G., Rochester district-heating-system reconfiguration: technical and economic feasibility. Final report, 14:31151 (R;US)
Hansen, A., Yaw dynamics of horizontal axis wind turbines: Second annual report, 14:30790 (R;US)
See Mikkelsen, T., 14:31909
Hansen, A.D.A., Real-time measurement of the size fractionation of aerosol black carbon during the South Coast Air Quality Study, June 13–September 4, 1987, Claremont College, Claremont, California: Final report: Revision, 14:31930 (R;US)
Real-time measurement of the size fractionation of aerosol black carbon during the Southern California Air Quality Study, June 13–September 4, 1987, Claremont College, California, 14:31932 (R;US)
Hansen, E.B., *See* Bruus, H., 14:32828
Hansen, K., *See* Knudsen, P., 14:30871
Hansen, O.P., *See* Bruus, H., 14:32828
Hansen, W. N., *See* Yu, B., 14:32510
Hanson, D.A., *See* Bando, A., 14:31918
Hanson, G., *See* Boyarski, A., 14:31854
See Findahl, O., 14:30923
Hanson, G.G., Triggering and data acquisition aspects of SSC tracking, 14:31855 (R;US)
Hanson, J. D., *See* Finn, J. M., 14:32540
Hanson, J.D., *See* Cary, J.R., 14:32900
Hanson, J.E., *See* Bartlett, P.A., 14:32087
Hansson, T. H., *See* Carrington, M. E., 14:32596
Hanumaiah, B., *See* Kerur, B.R., 14:32493
Hao Shiyin, *See* Li Xueli, 14:32068
Hardee, H.C., *See* Hills, R.G., 14:31609
Hardee, J.L., *See* Streetman, K.D., 14:32999
Hardesty, D.R., Coal Combustion Science quarterly progress report, October–December 1988, 14:30282 (R;US)
Harding, A., *See* Ophel, T.R., 14:31802
Hardwick, J.P., *See* Huberman, E., 14:32371
Hareland, W. A., *See* Williamson, R. L., 14:31888
Harfoush, F.A., Coherent betatron instability driven by electrostatic separators: Stability analysis of the Tevatron, 14:31713 (R;US)
Hargis, P.J. Jr., Plasma initiated laser etching and deposition of semiconductor materials, 14:31343 (BA;US)
Hargreaves, T. A., *See* Fliflet, A. W., 14:31889
Harkins, S.M., *See* Gangwal, S.K., 14:30250
Harlos, K., *See* Blake, C.C.F., 14:32171
Harmon, B. N., *See* Kim, B., 14:31261
Harms, L., Pre- and postoperative MRT findings in syringohydromyelia, 14:32301 (RA;DD;In German)
See Michalik, M., 14:32238
See Reichmuth, B., 14:32334
See Schulz, W., 14:32240
Haroun, L.A., *See* Peterson, J.M., 14:32026
Harper, J.B., Data Inventory System (DIS): A user's guide and programmer's manual, 14:33021 (R;US)
Harper-Slaboszewicz, V., *See* Stygar, W.A., 14:31873
Harriman, A., *See* Nahor, G.S., 14:31558
Harris, B., *See* Kasameyer, P., 14:32842
Harris, C.B., *See* Goncher, G.M., 14:31234
Harris, J., *See* Norford, L.K., 14:31038
Harris, J.D., *See* Levin, A.E., 14:30875
Harris, M.T., An orthogonal collocation approach to modeling multicomponent adsorption in carbon beds, 14:32037 (R;US)
Harris, P. G., *See* Tang, C. Y., 14:32525
Harris, R.A., Fast Flux Test Facility Passive Safety flow transient test, 14:30926 (R;US)
Harrison, I.G., *See* Joy, D.S., 14:30523
Harrison, R.F., *See* Shimada, T., 14:31650
Harrison, R.P., *See* Zanner, F.J., 14:31229
Harrison, W.T.A., Crystal structure of aluminum molybdate, $Al_2(MoO_4)_3$, determined by time-of-flight powder neutron diffraction, 14:31295 (J;US)
Hartl, W., Development of the fields of application of NMR imaging and NMR spectroscopy, 14:32340 (RA;DD;In German)
Hartley, I.J., *See* McCully, M.A., 14:31454
Hartouni, E. P., Some preliminary results from BNL E766 on $pp-\rightarrow pp\ K_S^0\ K\pi$, 14:32561 (J;US)
Harvey, J., *See* Holden, M.S., 14:31652
Harvey, M., *See* Massuda, M., 14:31456
Harvey, R., *See* Mayberry, M.J., 14:32871
Hasbrouck, R.T., Lightning: Understanding it and protecting systems from its effects, 14:31677 (R;US)
Hasebe, N., *See* Kohno, T., 14:32475
See Nagata, K., 14:32473
Haselow, J.S., A mathematical model of fluid flow in the vicinity of a horizontal air-injection well, 14:32033 (R;US)
Haseroth, H., Switched power workshop: Power supply working group, 14:31784 (R;US)
Hasert, V., *See* Eisenberg, B.M., 14:32335
Hassani, S., Contribution to the determination of nuclear friction by studying the de-excitation of nuclei in the transient regime, 14:32698 (R;FR;In French)
Particle evaporation-fission competition in nuclear fission considered as a diffusion process, 14:32697 (R;FR;In French)
Hauer, A., *See* Willi, O., 14:32896
Hauser, A.K., Steady-state and impedance analyses of electrochemical kinetics and mass transfer, 14:31551 (R;US)
Haustein, J., *See* Planitzer, J., 14:32338
Hautman, J., Molecular dynamics simulation of water beween two ideal classical metal walls, 14:31483 (J;US)
Havard, D.G., *See* Pon, C.J., 14:30815
Havlik, E., Assessment of internal contamination with a whole body counter, 14:31847 (RA;AT)
See Kletter, K., 14:32382
Hawkins, R.W., *See* Moschopedis, S.E., 14:30241
Hawkins, S.A., Building and energy-management systems: a user guide, 14:31067 (R;US)
Haxo, H.E. Jr., Liner-waste compatibility studies for coal-fired power plants, 14:31112 (R;US)
Haxo, P.D., *See* Haxo, H.E. Jr., 14:31112
Hayashi, M., Upgrading of shale oil by an ebullated-bed reactor, 14:30364 (RA;CN)
Hayashi, S., *See* Yamamoto, M., 14:30491
Hayashi, T., *See* Takahashi, Y., 14:32680
Hayashida, H., *See* Miyata, T., 14:32164
Hayashii, H., *See* Aston, D., 14:32551, 14:32558
Hayashiii, H., *See* Aston, D., 14:32549
Hayes, J.M., *See* Cooper, R.S., 14:31458
Hayes, K., *See* Wilde, B.E., 14:31236
Hayes, R.D., Proceedings of the 6th Canadian bioenergy research and development seminar, 14:31040 (R;CA)

Hayman, G.D., *See* Hall, I.W., 14:31512
Haynes, R.A., Imagine: A TACS [Test Analysis Computing System] interactive imaging system, 14:33010 (R;US)
Hazin, C.A., *See* Eichholz, G.G., 14:30618
He, Y., Thermal decomposition of methyl nitrite: kinetic modeling of detailed product measurements by gas-liquid chromatography and Fourier transform infrared spectroscopy, 14:31585 (J;US)
He-yuan, S., *See* Yung-Fu, S., 14:30952
Heacock, B.D., Annual site environmental report for calendar year 1988, United States Department of Energy, Kansas City Plant, Kansas City, Missouri, 14:31927 (R;US)
Headley, T.J., *See* Cieslak, M.J., 14:31227
Heald, R.L., Resonance Raman spectra of electrochemically generated chlorophyll a cation radical, 14:31554 (J;US)
Healy, M.H., *See* Arnett, E.M., 14:31516
Hearty, C., Search for the anomalous production of single photons in e^+e^- annihilation at $\sqrt{s}$ =29 GeV, 14:32577 (J;US)
Heath, C. E., *See* Sanford, T. W. L., 14:32888
Hebbard, D.F., /sup 20/Ne(/sup 16/O, /sup 16/O)/sup 20/Ne excitation function at θ/sub CM/ = 90 deg. and parity - dependent interactions, 14:32695 (R;AU)
Hebel, W., CEC research programme for treatment and conditioning of spent fuel hulls, 14:30476 (RA;US)
Hecke, P. van, *See* Baert, A.L., 14:32328
Hecktor, B.O., Cold district heating from a quarry at Kaageroed. Evaluation of an experimental building project, 14:31135 (R;SE;In Swedish)
Hecky, R.E., *See* Fee, E.J., 14:32028
Hedden, K., *See* Guo, S., 14:30338
Hedemann, M.A., *See* Fehl, D.L., 14:31851, 14:31869
Hedley, W.H., Improvements in efficiency, capacity, and reliability of Mound's effluent removal system, 14:32951 (J;US)
See Wieneke, R.E., 14:32935
Hedrich, E., *See* Boeck, H., 14:30917
Heffner, R. H., Muon spin rotation in the magnetic and superconducting ground states of (U,Th)Be_{13} and (U,Th)Pt_3, 14:31252 (J;US)
Hefner, A., *See* Mueck, K., 14:32015
See Tschirf, E., 14:32377
Hegedues, V., CT-cholegraphy, 14:32227 (RA;DD)
Heiberger, J., *See* Bloom, I., 14:31052
Heiken, G., Characterization of lunar ilmenite resources, 14:32431 (R;US)
Heimrich, B., Fine focusing of intense heavy ions for the production of hot dense matter, 14:31739 (R;DE;In German)
Heine, E., Investigation into modulators. Progress report, 14:31790 (R;NL;In Dutch)
Heinemann, H., *See* Marchon, B., 14:31523
Heino, P., Industrial load management in the Broby area, 14:31031 (R;SE;In Swedish)
Heinzelmann, M., Problems of personnel dose monitoring in mixed β-γ radiation fields caused by type licensing of thermoluminescent dosimeters, 14:31839 (RA;AT;In German)
Heiser, J.H. III, A process for solidifying sodium nitrate waste in polyethylene, 14:30454 (R;US)
Heitner, H., Indications and limits of CT from the orthopaedist's point of view, 14:32326 (RA;DD;In German)
Heldt, L.A., Stress corrosion cracking and metal-induced embrittlement: Local chemistry and local plasticity: Progress report, September 1, 1986–October 31, 1988, 14:31192 (R;US)
Helfand, M.A., *See* Diegle, R.B., 14:31292
Heller, D.F., *See* Band, Y.B., 14:31639
Heller, J.P., Improvement of CO_2 flood performance: Quarterly report, October–December 1988, 14:30291 (R;US)
Heller, M., Diagnosis of skeleton and soft parts by CT and MRT, 14:32325 (RA;DD;In German)
See Triebel, H.J., 14:32288
Hellstroem, B., Influence of convection on the temperature distribution and heat losses of solar collectors, 14:30759 (R;SE;In Swedish)
Helmerson, K., *See* Martin, A.G., 14:32487
Hembree, D. M., Jr., Anomalous dispersion effects in diffuse reflectance infrared fourier transform spectroscopy: A study of optical geometries, 14:31882 (J;US)
Hemley, R. J., X-ray diffraction and equation of state of solid neon to 110 GPa, 14:31370 (J;US)
Hemmi, Y., *See* Yoshida, T., 14:32579
Hemminger, J.C., *See* Giergiel, J., 14:31462
Hemphill, R.L., *See* James, B.J., 14:32939
See Nolen, R.L. Jr., 14:32938
Hender, B., *See* Karman, D., 14:30397
Henderson, D. J., *See* Beck, C., 14:32668
Henderson, I.M., *See* Penny, D., 14:32163
Henderson, J.M., *See* Gurley, R.N., 14:30499
Hendler, A., Annual report on establishment and operation of the eastern fine-particle and visibility network, 14:31958 (R;US)
Hendrickson, D.N., *See* Roginski, R.T., 14:31504
Hendy, M.D., *See* Penny, D., 14:32163
Henesian, M.A., Observation of parametric gain suppression in stimulated rotational Raman scattering over long air paths, 14:32887 (BA;US)
See Pennington, D.M., 14:31645
Henkes, H., Comparison of CT and MRT in intracranial inflammations and infections, 14:32336 (RA;DD;In German)
See Schoerner, W., 14:32244
Henley, B.F., *See* Campbell, R.D., 14:30902
Henley, E. M., Nambu–Jona-Lasinio model and charge independence, 14:32622 (J;US)
Hennart, D., *See* Van de Voorde, N., 14:30493
Hennigor, S., Recurrent analyses of radiation protection conditions at the Swedish nuclear power plants, 14:30629 (RA;AT)
Henning, C., Magnet design technical report—ITER definition phase, 14:32932 (R;US)
Henning, K., Criteria for choice of decontaminating agents for trouble-free processing of radioactive waste waters from the control area of nuclear power plants, 14:30568 (RA;AT;In German)
Henrich, E., Chernobyl - measurements by the Austrian Environmental Protection Agency, 14:32017 (RA;AT)
Medical radionuclides in the Austrian environment, 14:32011 (RA;AT)
Henry, E.A., *See* Roy, N., 14:32682
Henry, R.E., *See* Hutcherson, M.N., 14:30508
Henschel, A., *See* Lainhart, W.S., 14:30284
Hentschel, M., /sup 1/H-NMR spectroscopy - a new method in tumor diagnosis?, 14:32261 (RA;DD;In German)
Herbots, N., *See* Appleton, B.R., 14:31346
Herchenroeder, J. W., Magnetic behavior in Mg-stabilized bcc β-Gd and β-Dy, 14:31254 (J;US)
Herczeg, P., Pion and muon decays beyond the standard model, 14:32589 (R;US)
Heritier, J., *See* Balladon, P, 14:31205
Hermann, O.W., Multicode comparison of selected source-term computer codes, 14:30569 (R;US)
Hermanska, J., *See* Rimpler, A., 14:32777
Hermes, J.D., Development of enzyme catalytic efficiency: an experimental approach, 14:32138 (BA;US)
Herndon, J.N., *See* Feldman, M.J., 14:30438
Herold, T.R., *See* Rankin, W.N., 14:31592
Herriges, J.A., *See* Caves, D.W., 14:31023
Herrmann, H., *See* Huebel, K., 14:32072
Herrmannsfeldt, W.B., *See* Allen, M.A., 14:31771
Herrold, R.E., *See* Beale, J.M., 14:31507
Herron, S.A., *See* Cooley, J.N., 14:30625
Herschman, H.R., *See* Birren, B.W., 14:32199
Herss Nielsen, V.A., *See* Hegedues, V., 14:32227
Herstad, S., Environmental measurements at the Korsta CFB-boiler, 14:30801 (R;SE;In Swedish)
Hertel, G., *See* Nelson, T., 14:30610
Hertz, H.M., *See* Burden, A.D., 14:31581
Hertzberg, M., Prevention of oil shale dust explosions, 14:30417 (RA;CN)
Hervig, R. L., *See* Rovetta, M. R., 14:30761
Hervin, R.L., Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri, 14:31960 (R;US)
Herz, H., *See* Jochem, E., 14:30806

Hestir, K., *See* Long, J.C.S., 14:32433
Heuze, F.E., *See* Blair, S.C., 14:32435
Heyraud, J., *See* Pajot, J., 14:30847
Hickman, D.L., *See* Masarwa, M., 14:31501
Hieckel, H.G., N classification in preoperative staging of bronchial cancer by means of CT, 14:32286 (RA;DD;In German)
See Bickhardt, J., 14:32285
Higaki, J.N., Evolution of catalysis in the serine proteases, 14:32140 (BA;US)
Higbee, C.V., Engineering cost analysis, 14:30783 (RA;US)
Hijalmarson, H.P., *See* Zutavern, F.J., 14:31672
Hildenbrand, D., *See* Dickinson, P. H., 14:31296
Hill, C.G. Jr., *See* Gieselmann, M.J., 14:31432
Hill, D., *See* Auer, I. P., 14:32575
Hill, K. W., *See* Beiersdorfer, P., 14:32890
Hill, M.K., Lowering kraft black liquor viscosity of ultrafiltration, 14:31436 (J;US)
Hills, B., Industrial-hygiene survey, Bachmeier and Company, Kearny, New Jersey, November 4-8, 1985, 14:31952 (R;US)
Hills, R.G., Feasibility study for a periodic downhole seismic source, 14:31609 (R;US)
Himel, T., *See* Klein, S. R., 14:32574
Himel, T.M., *See* Adolphsen, C.E., 14:31776
Himmel, M., *See* Grohmann, K., 14:30711
See Shiang, M., 14:30725
Himmel, M.E., Enzymology research, 14:30714 (RA;US)
See Baker, J.O., 14:30716, 14:30717
See Grohmann, K., 14:30718
See Tatsumoto, K., 14:30715
See Tucker, M.P., 14:30721, 14:30722
Hinckley, J.E., *See* Rej, D.J., 14:32923
Hinde, D.J., *See* Leigh, J.R., 14:32674
Hines, W.A., *See* Zhang, Z., 14:31249
Hinkel-Lipsker, D. E., Analytic expression for mode conversion of Langmuir and electromagnetic waves, 14:32537 (J;US)
Hinks, D. G., *See* Loong, C., 14:31302
Hinks, D.G., *See* Dabrowski, B., 14:31270
Hinman, N.D., Xylose fermentation analysis, 14:30668 (RA;US)
Hintsa, E.J., Infrared multiphoton dissociation of ethyl and methyl acetate, 14:31560 (J;US)
Hinz, G., *See* Schwarz, E.R., 14:32350
Hioe, F. T., Lossless propagation of optical pulses through *N*-level systems with Gell-Mann symmetry, 14:32847 (J;US)
Hipolito, O., *See* Basmaji, P., 14:32789
See Degani, M.H., 14:32793
Hirata, F., Viewing the born model for ion hydration through a microscope, 14:31476 (BA;US)
Hirata, S., *See* Sherman, R.H., 14:32963
Hirdes, V.R., Transient performance of flow in circuits of PWR type reactors, 14:30837 (R;BR;In Portuguese)
Hiromoto, G., Environmental monitoring program of the uranium enrichment facility Almirante Alvaro Alberto, 14:30624 (R;BR;In Portuguese)
Hirst, E., Benefits and costs of small, short-lead-time power plants and demand-site programs in an era of load-growth uncertainty, 14:30797 (R;US)
Integrated resource planning: a view from the trenches, 14:31011 (RA;US)
Hjalmarson, H.P., *See* Loubriel, G.M., 14:31673
Ho, Cheng, Spectra of crab-like pulsars: A GRO perspective, 14:32459 (R;US)
Ho, N.W.Y., Cloning of the xylulokinase gene for improved yeast xylose fermentation. I.Cloning the yeast xylulokinase gene by complementation of E. coli xylulokinase mutation, 14:30733 (RA;US)
Ho, S.P., *See* DeGrado, W.F., 14:32129
Hoag, H.A., *See* Allen, M.A., 14:31771
See Deruyter, H., 14:31772
Hoagland, W., *See* Brennan, A., 14:30657
See Hinman, N.D., 14:30668
Hochstrasser, R.M., *See* Thorne, J.R.G., 14:31557
Hockney, G., *See* Erber, T., 14:32844
Hodge, J., *See* Bair, A., 14:31172
Hodge, K., *See* Alexander, J.A., 14:31701
Hodge, K.C., *See* Denison, G.J., 14:32931
Hodgins, D.O., *See* Hodgins, S.L.M., 14:32440
Hodgins, S.L.M., Evaluation of wave forecasting models and forecast wind fields in the Canadian context, 14:32440 (R;CA)
Hodgson, P.E., Multistep processes in neutron-induced reactions, 14:32729 (RA;SU)
Hoefert, M., *See* Goebel, K., 14:32770
Hoehlein, G., *See* Wiese, H., 14:30509
Hoehne, K.H., Procedure of the three-dimensional representation of tomographic image arrays, 14:32320 (RA;DD;In German)
Hoeijer, B., *See* Findahl, O., 14:30923
Hoelscher, B., *See* Bowles, E.C., 14:30679
Hoen, J., New independent multi user/multi tasking radiotherapy treatment planning-system with on- and off-line datatransfer from CT or NMR, 14:32341 (RA;DD)
Hof, D. E., *See* Simons, J. W., 14:32515
Hoffman, D.C., Spontaneous fission of the heaviest elements, 14:32739 (R;US)
Hoffman, L., *See* Holt, E.C., 14:30798
Hoffmann, E.L., *See* Giles, M.S., 14:30621
Hofmann, I., Filamentation of phase space and coherent noise for beams injected into storage rings, 14:31740 (R;DE)
Hofmann, P.J., PWR steam generator tube fretting and fatigue wear: Final report, 14:30839 (R;US)
Hofmann, W., *See* Rahim, H., 14:32388
See Tschurlovits, M., 14:32774
Hogan, B. L., Indirect fluorometric detection in gel electrophysics, 14:31404 (J;US)
Hoh, Y.C., *See* Ju, S.J., 14:30430
Hohlfeld, K., *See* Kramer, H.M., 14:32776
Hohlwein, D., *See* Axe, J. D., 14:31303
Holbraten, S., *See* Beise, E. J., 14:32658
Holden, M.S., Studies of the structure of attached and separated regions of viscous/inviscid interaction and the effects of combined surface roughness and blowing in high-Reynolds-number hypersonic flows. Final report, 1 August 1985-1 June 1988, 14:31652 (R;US)
Holland, M.K., Determination of neptunium by controlled-potential coulometry, 14:30441 (R;US)
Holland, R., *See* Lyman, J.L., 14:31547
Holland, S.I., *See* Hawkins, S.A., 14:31067
Holland, S.K., *See* Blake, C.C.F., 14:32171
Holler, H.F., Studies on the architecture and function of 16S rRNA, 14:32149 (BA;US)
Hollinrake, A., *See* Morris, J.B., 14:30519
Hollnagel, R., *See* Siebert, B.R.L., 14:31835
Holloway, J. R., *See* Rovetta, M. R., 14:30761
Holm, G., *See* Jerneloev, A., 14:32397
Holm, T., Low temperature thermal aquifer storage. A full scale experiment with the purpose of avoiding long term cooling of the subsurface environment, 14:30934 (RA;CA;In English and French)
Holm, T.R., *See* Hoyer, M.C., 14:30946
Holman, R., *See* Choi, K., 14:32621
Holmes, J.M., Countermeasures to hazardous chemicals, 14:31936 (R;US)
Holmgren, S., *See* Briggs, D., 14:31853
Holroyd, R., *See* Nishikawa, M., 14:31572
Holsbeck, M. van, *See* Baert, A.L., 14:32328
Holt, E.C., Technical/economic impacts and implications of using washed coals at New York State utilities. Final report, 14:30798 (R;US)
Holten, J.R., *See* Uncapher, W.L., 14:30593
Holuszko, M., *See* Gawlak, M., 14:30242
See Parkash, S., 14:30269
Honarpour, M., Integrated reservoir assessment and characterization: Final report, October 1, 1985–September 30, 1988, 14:30293 (R;US)
Honigs, D. E., *See* Angel, S. M., 14:31356
Honzatko, R., *See* Wroblewski, A.E., 14:31497
Hooper, E.B., *See* Stallard, B.W., 14:32886
Hopkins, D., *See* Haseroth, H., 14:31784
Hopkins, D.B., Elements of a realistic 17 GHz FEL/TBA design, 14:31697 (R;US)

Hopky, G.E., Salinity, temperature and density data for the Canadian Beaufort Sea shelf, March 1988, 14:32439 (R;CA)
Hopper, R.W., Low density microcellular carbon or catalytically impregnated carbon forms and process for their preparation, 14:31381 (P;US)
Horan, J.R., Worldwide trends in occupational exposures at nuclear power plants, 14:30914 (RA;AT)
Horner Kuper, J.B., *See* Rowe, M.S., 14:30986
Horsdal, E., *See* McGuire, J. H., 14:32518
Horsley, G., *See* Morris, J.B., 14:30519
Horsley, J. A., *See* Davis, R. J., 14:31304
Horton, J.A., *See* McKamey, C.G., 14:31245
Horton, W.H., *See* O'Kula, K.R., 14:32958
Horvatincic, N., *See* Obelic, B., 14:30884
Horwitz, E.P., *See* Nash, K.L., 14:31571
See Schulz, W.W., 14:30619
Horwitz, N., *See* Bortoletto, D., 14:32573
Hoshino, M., Time evolution from linear to nonlinear stages in magnetohydrodynamic parametric instabilities, 14:32465 (J;US)
Hosotani, Y., Dynamics of non-integrable phases and gauge symmetry breaking, 14:32637 (J;US)
Hossenlopp, I.A., *See* Steele, W.V., 14:30311
Hosten, N., MRT in endocrine orbitopathia, 14:32257 (RA;DD;In German)
See Bittner, R., 14:32284
Hou Fagao, *See* Shen Minzi, 14:32056
Hou, X., Prospect of oil shale and shale oil industry, 14:30410 (RA;CN)
Houk, R.S., *See* Plantz, M.R., 14:31400
Houle, S., *See* Noiseux, D.U., 14:30812
Hourani, E., *See* Fortier, S., 14:32664
Housse, B.A., Prototype of underground high-temperature heat storage in Thiverval-Grignon (France), 14:30933 (RA;CA;In French)
Houston, J.V., *See* Casper, R.M., 14:30822
Hov, Oe., Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)
Howard, G., *See* DeLong, T., 14:30867
Howard, J., *See* Nicol, J.M., 14:31545
Howard, M.B., *See* Wertz, G.W., 14:32113
Howe, G.B., *See* Fulcher, J.N., 14:31951
See Jayanty, R.K.M., 14:31989
Howes, J., *See* Hendler, A., 14:31958
Hoyer, E., *See* Keller, R., 14:31761
Hoyer, E.H., *See* Hopkins, D.B., 14:31697
Hoyer, M.C., Short-term aquifer thermal energy storage (ATES) test cycles, 14:30946 (RA;CA;In English and French)
Hoza, M., *See* Ward, A.L., 14:30615
Hradil, G., *See* Calo, J.M., 14:30659
Hsieh, C.R., *See* Laity, D.S., 14:30380
Hsiu, F.J., *See* Ng, C.K., 14:30492
Hsiung, Y. B., *See* Yoshida, T., 14:32579
Hu, H., *See* Guo, S., 14:30338
Hu, X., Fluidized bed electrowinning of chromium from very dilute solutions, 14:31450 (J;US)
Hua, T.Q., MHD flow in insulating circular ducts for fusion blankets, 14:32898 (R;US)
Huang, D., Interference effects probed by photoreflectance spectroscopy, 14:31352 (J;US)
See Liao, Z., 14:30374
Huang, E.C., Direct heated interface probe for capillary supercritical fluid chromatography/double focusing mass spectrometry, 14:31461 (J;US)
Huang, G., *See* Guo, S., 14:30338
See Wang, X., 14:30357
Huang, J.L., *See* McEntire, B.J., 14:31291
Huang, J.S., Deformation and failure mechanisms of niobium and tantalum during tensile testing in uranium at 1473 K, 14:31240 (J;US)
Huang, X.Y., *See* Mader, W., 14:31244
Huang, Y., Doubly charged gas-phase heteronuclear cluster ions: synthesis and reaction of $LaFe^{2+}$ with small hydrocarbons, 14:31506 (J;US)
See Lu, S., 14:30377
Huber, E.L., Reliability of protection measures used in solving optimization tasks in radiation protection, 14:30628 (RA;AT;In German)
Huberman, E., "Normal" tissues from humans exposed to radium contain an alteration in the c-mos locus, 14:32371 (R;US)
Huebel, K., Radiological analysis of the upper Danube river system - a 20 years research programme, 14:32072 (RA;AT;In German)
Huennekens, J., *See* Keramati, B., 14:32481
Huff, E. A., The determination of impurities in plutonium metal by anion exchange and ICP/AES, 14:31242 (J;US)
Hufner, J., *See* Gerschel, C., 14:32732
Huggins, R.A., *See* Deublein, G., 14:31050
Hughes, V. W., *See* Kuang, Y., 14:32526
Hugony, P., *See* Jouan, A., 14:30497
Hulet, E. K., *See* Moody, K. J., 14:32693
Hull, J. R., Kelvin-Helmholtz instability and cooling limitations of a vertical molten sheet confined by alternating magnetic fields, 14:31659 (J;US)
Hull, J.R., Attractive levitation for high-speed ground transport with large guideway clearance and alternating-gradient stabilization, 14:31593 (R;US)
Hulse, R. A., *See* Beiersdorfer, P., 14:32890
Hulsebos, J., Modified-in-situ technology combined with aboveground retorting and circulating fluid bed combustors could offer a viable method to unlock oil shale reserves in the near future, 14:30360 (RA;CN)
Hummel, S.G., *See* Cox, H.M., 14:31231
Hung, J., *See* Aumayr, F., 14:32507
See Hagelstein, P.L., 14:31634
Hunsdiek, F.W., Neuroradiological changes in AIDS, 14:32337 (RA;DD;In German)
Hunter, K.C., *See* Weaver, N.L., 14:31091
Hunter, R.L., *See* Bertram-Howery, S.G., 14:30590
Hurley, J.K., Interaction of halide and pseudohalide ions with triplet benzophenone-4-carboxylate: kinetics and radical yields, 14:31559 (J;US)
Hurst, J.K., *See* Lu, T., 14:31542
Hurwitch, J.W., Demand-side load leveling battery storage at the Princeton Plasma Physics Laboratory, 14:30928 (BA;US)
Husain, A., *See* Williamson, A.S., 14:30481
Husk, G.R., *See* Kim, T.H., 14:31427
Hussey, T.W., Z-pinch modeling at Sandia National Laboratories, 14:31631 (R;US)
Hutcherson, M.N., Steam explosions in slurry fed ceramic melters, 14:30508 (RA;US)
Hutchinson, B.J., *See* Arnett, E.M., 14:31516
Hutson, R. L., *See* Heffner, R. H., 14:31252
Huttar, D.E., *See* Hurwitch, J.W., 14:30928
Hutton, A., *See* Bambade, P., 14:31723
Hwa, R.C., Geometrical scaling, furry branching and minijets, 14:32583 (R;US)
Hwang, D.M., *See* Cox, H.M., 14:31231
See Morais, P.C., 14:31230
Hwang, K., Supercomputers for solving PDE problems. Final report, 1 October 1985-31 March 1988, 14:32980 (R;US)
Hyden, H., Aquifer heat storage technology in Sweden, 14:30932 (RA;CA;In English and in French)
Hyman, J. M., *See* Dougherty@f—, R. L., 14:33017

I

Iachello, F., Parity doubling in baryons and its relevance to hadronic structure, 14:32620 (J;US)
See Frank, A., 14:32509
Ibrahim, F.Y., *See* Ghosh, D., 14:31320
Ichimaru, S., *See* Tajima, T., 14:32703
Ideno, K., *See* Sugiyama, Y., 14:32667
Idriss, I.M., *See* Campbell, R.D., 14:30902
Idzerda, Y. U., Structure determination of metastable cobalt films, 14:31247 (J;US)
Igarashi, H., *See* Sasaki, N., 14:30501
Ignatochkin, A.E., Incorporation of internal conversion coefficients into the ENSDF data sets, 14:32712 (RA;XA)

Ignatyuk, A.V., Description of neutron strength functions with allowance for multi-channel coupling, 14:32728 (RA;SU;In Russian)
See Grudzevich, O.T., 14:32725
Igo, G., *See* Naudet, C., 14:32659
Iikawa, F., Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
Ikezi, H., *See* Haseroth, H., 14:31784
Ikezoe, H., *See* Sugiyama, Y., 14:32667
Ilias, S., Fouling of thin-channel and tubular membrane modules by dilute suspensions, 14:31435 (J;US)
Imanishi, B., *See* Oertzen, W. von, 14:32709
Imasava, F.J., *See* Rodrigues, S., 14:32430
Imhof, H., Diagnosis of skeleton and soft tissues by CT and MRT, 14:32309 (RA;DD;In German)
Imlay, R., *See* Park, I. H., 14:32570
Indacochea, J.E., Electrochemical reactions in submerged arc welding with SiO_2-CaO-CaF_2 fluxes with high and low silica contents, 14:31274 (R;US)
Electrochemical transport of manganese between the flux and the weld metal in submerged arc welding, 14:31275 (R;US)
Ingalls, R., *See* Freund, J., 14:31256
Ingber, M.S., *See* Hailey, C.E., 14:31603
Inokuchi, H., *See* Ozeki, H., 14:32158
Inokuti, M., *See* Kimura, M., 14:32489
See Kowari, K., 14:32755
Inoue, T., *See* Kay, P.S., 14:32094
Iomonosov, V.I. and othe, *See* Vishnevskij, L.N., 14:32666
Iris, P., Heat storage and heat pumps on aquifer. Two case studies, 14:30931 (RA;CA;In English and French)
Isaenko, V.I., Clinical dosimetry at remote neutron therapy irradiation in Kiev U-120 cyclotron, 14:32762 (RA;SU;In Russian)
See Koval', G.N., 14:32763
Isherwood, I., Tissue discrimination - advances in CT and MRI, 14:32249 (RA;DD)
Ishihara, T., *See* McGuire, J. H., 14:32518
Ishiwatari, M., Application of pyrolysis gas chromatography to examination of behavior in retorting of various oil shales, 14:30386 (RA;CN)
Iskander, S.K., *See* Nanstad, R.K., 14:31183
Isocele Collaboration, *See* Roussiere, B., 14:32669
Isupov, V.Yu., *See* Evlanov, M.V., 14:32736
Itie, J.P., *See* Gerward, L., 14:31328
See Staun Olsen, J., 14:31327
Itoh, K., *See* Nishikawa, M., 14:31572
Ivanitskij, P.G., Study of cooperative processes in polymer gels by the method of slow neutron transmission, 14:32800 (R;SU;In Russian)
Ivanov, E.V., New trends in skin protection from ionizing radiations, 14:32374 (RA;SU;In Russian)
Ivchenko, I.N., *See* Afanasiev, V.L., 14:32455
Ives, H.C., *See* Stygar, W.A., 14:31873
Iveson, R., Bulk power contracts: valuing reliability, 14:31030 (RA;US)
Iwata, S., *See* Aston, D., 14:32549, 14:32551, 14:32558
Iyer, M.R., *See* Achuthan, P.V., 14:31383
Iyer, R., *See* Theis, T.L., 14:32048
Iyer, S.S., *See* Shihomatsu, H.M., 14:30428, 14:31390, 14:31391
Iyetomi, H., *See* Tajima, T., 14:32703
Izard, M.E., Dosimetry and irradiation methods for the ANSTO gamma technology research irradiator (GATRI), 14:30643 (R;AU)
Izatt, R.M., Comparison of bulk, emulsion, thin sheet supported, and hollow fiber supported liquid membranes in macrocycle-mediated cation separations, 14:31428 (J;US)
Proton-ionizable crown compounds: transport of alkali and alkaline earth cations using proton-ionizable triazolo macrocycles, 14:31439 (J;US)
Izrajlev, F.M., Intermediate statistics of quasienergy spectrum and quantum localization of classical chaos, 14:32826 (R;SU;In Russian)

J

Jablonski, W., *See* Laser, M., 14:30484
Jacak, B.V., *See* Wilhelmy, J.B., 14:32681
Jackson, B.J., *See* Huang, E.C., 14:31461
Jackson, D.W., *See* Marietta, M.G., 14:30577
Jackson, S., *See* Honarpour, M., 14:30293
Jacob, N.P., Methods for improved radwaste ion-exchange processing, 14:30457 (RA;US)
Jacob, P., *See* Meckbach, R., 14:31600
Jacobs, J., *See* Ghosh, D., 14:31320
Jacobsen, R., *See* Rolfe, J., 14:31779
Jacobson, R.A., *See* Wroblewski, A.E., 14:31497
Jacobsson, A., *See* Grimaas, U., 14:30887
Jacomino, V.M.F., *See* Hiromoto, G., 14:30624
Jacquemin, J., *See* Kroeger, W., 14:30910
Jacquier, A., *See* Michel, F., 14:32206
Jaeckle, J.W., Tritium distribution modeling in a Light Water New Production Reactor, 14:30894 (R;US)
Jaeger, J.A., *See* Turner, D.H., 14:32092
Jaeggin, K., Environmental and energy performance, 14:31078 (R;CA;In English and French)
Systems and material performance, 14:31080 (R;CA;In English and French)
Jaenisch, W., *See* Schulz, W., 14:32240
Jaffeson, R.C., *See* Holt, E.C., 14:30798
Jahagirdar, H.A., *See* Kerur, B.R., 14:32493
Jahnke, F.M., A radially perfused cell for measuring diffusion in compacted, highly sorbing media, 14:31353 (J;US)
Jahr, R., *See* Siebert, B.R.L., 14:31835
Jakob, F.E., Gas-engine heat-pump system and component efficiency and reliability improvement. Phase 2 report, September 1986-January 1989, 14:31074 (R;US)
Jalbert, R.A., U.S. team measurements during the June 1987 experimental HT release at the Chalk River Nuclear Laboratories, Ontario, Canada, 14:32960 (J;US)
James, A.C.W.P., Structural and NMR study of the lithiated defect thiospinels $Li_xCu_{0.07}[Ti_2]S_4$ ($0 < x < 2$), 14:31481 (J;US)
James, B.D., *See* Pace, N.R., 14:32100
James, B.J., Estimating the tritiated hydrocarbon decontamination factor by heavy methane, 14:32939 (J;US)
See Nolen, R.L. Jr., 14:32938
James, D.W., Radwaste processing services - examination of future role, 14:30470 (RA;US)
James, R. B., *See* Chang, Y., 14:32812
Jamil, M.A., *See* Dyer, A., 14:30532
Janda, K., *See* Tramontano, A., 14:32088
Janda, K.C., Quantum state resolved desorption of CO from solid surfaces: Progress report, 15 June 1988–14 June 1989, 14:31469 (R;US)
Jang, H., *See* Farkas, D., 14:32809
Jang, S.K., *See* Paul, A.V., 14:32110
Jankowiak, R., *See* Cooper, R.S., 14:31458
See Zamzow, D., 14:32402
Jans, E., *See* Lanen, J. B. J. M., 14:32660
Jansen, J.F., Analysis and control of a three-degree-of-freedom robot platform, 14:31594 (R;US)
Janson, C.A., *See* Eisenberg, D., 14:32125
Janssens, R. V. F., *See* Beck, C., 14:32668
Jansson, Aa., Task report: Stockholm no 1564/881110. Technique - Fuel preparation, 14:30675 (R;SE;In Swedish)
Jarem, J.M., Analysis of a probe-metallic sleeve feed system for a rectangular waveguide, 14:31615 (R;US)
Jarrell, K.A., *See* Peebles, C.L., 14:32098
Jauho, A.P., Tunneling through a time-modulated barrier - relation to tunneling times, 14:32833 (R;DK)
Jayanthi, U.B., Measurements of low energy gamma radiation balloon experiment for supernova 1987A, 14:31798 (RA;BR)
See Villela, T., 14:31797
Jayanty, R.K.M., Annual report on performance-audit results for POHC (Principal Organic Hazardous Constituents) testing during RCRA trial burns, 14:31989 (R;US)
See Fulcher, J.N., 14:31951

Jefferies, N.L., Long-term solute diffusion in a granite block immersed in sea water, 14:30561 (R;FR)
Jeffries, A.C., *See* Forster, A.C., 14:32101
Jeffries, C. D., Nonlinear electrodynamics in the granular superconductor $YBa_2Cu_3O_7$: Experiments and interpretation, 14:31307 (J;US)
Jeffries, H.E., Validation testing of new mechanisms with outdoor chamber data. Volume 1: comparison of CB4 and CAL mechanisms. Final report, April 1986-September 1988, 14:31939 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 3: calculation of photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31941 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 4: appendixes to photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31942 (R;US)
Jegle, U., Model investigations for trace analysis of iodine, uranium, and technetium in saturated sodium chloride leaching solutions of stored radioactive waste, 14:30565 (R;DE;In German)
Jencks, W.P., Economics of enzyme catalysis, 14:32085 (BA;US)
Jenkin, M.E., *See* Hall, I.W., 14:31512
Jenkins, E.M., *See* Binning, K.E., 14:32947
See Carlson, R.V., 14:32943
Jenkins, M.W., *See* Pfeifer, K.B., 14:31875
Jenkins, T., *See* Rolfe, J., 14:31779
Jenkovszky, L.L., Measurement of rho(S)=ReT(S,O)/ImT(S,O) at the collider and its interpretation in a model with odd-c exchange, 14:32588 (R;SU)
See Chikovani, Z.E., 14:32586
Jennebach, M., Investigation of a newly developed, multistage combustion system, 14:31580 (R;DE;In German)
Jennings, E., Buffalo district heating and cooling system: technical and economic assessment. Final report, 14:31150 (R;US)
Jennrich, C., *See* Weissburg, J.A., 14:31591
Jensen, D., *See* Hartouni, E. P., 14:32561
Jenzer, U., *See* Mini, R., 14:31836, 14:31837
Jephcoat, A. P., *See* Hemley, R. J., 14:31370
Jeppesen, C., *See* Gerbi, S.A., 14:32150
Jercinovic, M.J., Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass, 14:30604 (R;SE)
Jerneloev, A., Recovery processes in marine ecosystems, 14:32397 (R;SE)
Jernigan, J.R., *See* Shanklin, S.A., 14:31949
Jesus, A.P., M-subshell ionization of U by light ion bombardment, 14:32499 (RA;BR)
Jeter, S.M., *See* Garrett, D.L., 14:30747, 14:30748
Jezko, J., *See* McElroy, R., 14:31681
Ji Liqiang, *See* Zhu Rongbao, 14:31806
Jiang, P. Z., *See* Shi, D., 14:31300
Jiao Huixian, *See* Li Huiyun, 14:30896
Jiao Rongzhou, *See* Zhou Shunli, 14:31805
Jimenez, A., *See* Sabate, J., 14:32213
Jimenez, F., *See* Aldape, F., 14:31906
Jin, K., *See* Cai, M., 14:30419
Jin, Y., *See* Bennhold, C., 14:32602
Jirjis, B., *See* Muralidhara, H.S., 14:31455
Jobe, R.K., *See* Ronan, M.T., 14:31792
Jochem, E., Ecological effects of coal use. Final report, 14:30806 (R;DE;In German)
Joens, E., Building constructions using cement containing a desulfurization product, 14:31116 (R;DK;In Danish)
Johansson, A., Test program for electric vehicles and a follow-up of Swedish activities in this area, 14:31162 (R;SE;In Swedish)
Johansson, L., Energy forest east. Progress report 1987-1988, 14:30740 (R;SE;In Swedish)
Johansson, S., *See* Eriksson, A., 14:30935
Johns, E.E., *See* Ellefson, R.E., 14:32955
Johnson, A. S., *See* Hearty, C., 14:32577
Johnson, A.W., Laser-initiated chemical vapor etching of ceramics, 14:31289 (BA;US)
Johnson, C.T., *See* Rao, P.S., 14:30298
Johnson, D.C., Electrocatalysis of anodic oxygen-transfer reactions at doped lead dioxide, 14:31051 (BA;US)
Johnson, D.K., Design and testing of an autoclave system for lignin hydrotreating, 14:30737 (RA;US)
See Black, S., 14:30666
See Chum, H.L., 14:30736
Johnson, D.L., *See* Alexander, J.A., 14:31701
See Denison, G.J., 14:32931
See Ramirez, J.J., 14:32930
Johnson, D.O., *See* Sullivan, B.J., 14:30321
Johnson, D.W., *See* Arunasalam, V., 14:32881
Johnson, G.A., *See* Kamperschroer, J.H., 14:32928
Johnson, G.L., *See* Nelson, T., 14:30610
Johnson, J.A., *See* Smith, J.A., 14:31110
Johnson, J.O., *See* Smith, M.S., 14:33029
Johnson, J.W., *See* Olsen, D.K., 14:31786
Johnson, K.A., Observation of crystallographic texture and J/sub c/ anisotropy in bulk shock-compacted YBa/sub 2/Cu/sub 3/O/sub 7-x/ powders, 14:31297 (J;US)
See Fierke, C.A., 14:32142
Johnson, M. B., Carrier lifetimes in ion-damaged GaAs, 14:31357 (J;US)
Johnson, R. A., Alloy models with the embedded-atom method, 14:31257 (J;US)
Johnson, R.P., *See* Angus, R.O. Jr., 14:31482
Johnson, S. A., The use of diffuse reflectance infrared spectroscopy for studies of molecular sieve catalysis, 14:31415 (J;US)
Johnson, T.C., Current regulatory issues, 14:30633 (RA;US)
Johnston, C. T., *See* Scott, A. C., 14:31375
Johnston, G. W., Energy distribution of the CN products of the H+HCN, H+ClCN, and F+HCN reactions, 14:31544 (J;US)
Johnston, J.W., *See* Bates, S.O., 14:30573
Jojaji, H., *See* Finger, S.M., 14:30506
Joly, S., *See* Dei-Cas, R., 14:31731
Jona, F., *See* Wu, S. C., 14:31260
Jonah, C.D., *See* Chernovitz, A.C., 14:31573
See Liu, A., 14:31528
Jones, A.M., Operating instructions for the collection and analysis of x-ray diffraction data using a position sensitive detector system, 14:32782 (R;GB)
Jones, B. T., *See* Glick, M. R., 14:31883
Jones, C.R., *See* Dutta, J.M., 14:31267
Jones, G. II, Long-lived quinone-naphthalene triplet excited complexes: direct measure of rates of proton transfer within intimate radical ion pairs, 14:31566 (J;US)
Jones, H.K., Separation and characterization of colloidal materials of variable particle size and composition by coupled column sedimentation field-flow fractionation, 14:31410 (J;US)
See Smith, R.D., 14:31452
Jones, H.W., Analytical evaluation of multicenter molecular integrals over Slater-type orbitals using expanded Loewdin alpha functions, 14:32483 (R;US)
Jones, K.W., Trace element determinations with synchrotron-induced x-ray emission, 14:31463 (J;US)
Jones, L., Equipment and systems evaluation. Energy performance, 14:31083 (R;CA;In English and French)
Global evaluation. Energy performance, 14:31082 (R;CA;In English and French)
Retrofit evaluation. Energy performance, 14:31090 (R;CA;In English and French)
Jones, M. E., *See* Wilks, S. C., 14:31710
Jones, R.A., *See* Garrett, D.L., 14:30747, 14:30748
Jones, R.H., *See* Sanders, T.L., 14:30580
Jones, R.W., Transient infrared emission spectroscopy, 14:31407 (J;US)
Jones, W.D., Transition metal activation and functionalization of carbon-hydrogen bonds: Progress report, December 1, 1988–November 30, 1989, 14:31466 (R;US)
Jong Sung Ahn, Environmental isotope-aided studies on river water and groundwater interaction in the region of Seoul and Taegu, 14:32060 (RA;XA)

Environmental isotope-aided studies on water resources in the region of Cheju, 14:32061 (RA;XA)
Jonker, B. T., *See* Idzerda, Y. U., 14:31247
Jonson, M., *See* Jauho, A.P., 14:32833
Jordan, H., *See* Sanders, T.L., 14:31606
Jorgensen, D.W., An analysis of soil and surface properties which affect infiltration and runoff on mined lands, Centre County, Pennsylvania, 14:32025 (R;US)
Jorgensen, J. D., *See* Loong, C., 14:31302
Jorgensen, J.D., *See* Dabrowski, B., 14:31270
Joseph, M., *See* Karunasagar, D., 14:31447
Jouan, A., Vitrification plants in France, 14:30497 (RA;US)
Joy, D.S., Modeling the design and operations of the federal radioactive waste management system, 14:30523 (R;US)
Joyce, G.F., Nonenzymatic template-directed synthesis of information macromolecules, 14:32083 (BA;US)
Jozefiak, T.H., *See* Kenny, P.W., 14:31509
Ju, S.J., Study of the INER process for uranium recovery from wet-process phosphoric acid, 14:30430 (J;US)
Judd, A.K., *See* Loew, G., 14:32181
Judd, D.L., Concepts, features, and design of a sixteen-to-four beam combiner for ILSE [Induction Linac Systems Experiment], 14:32924 (R;US)
Jukes, T.H., Evolution of anticodons: variations in the genetic code, 14:32156 (BA;US)
See Osawa, S., 14:32157
Jung, C.K., *See* Kent, J., 14:31778
See Levi, M., 14:31777
Jung, K., *See* Gruender, W., 14:32271
Jungling, T.L., *See* Johnson, T.C., 14:30633
Junkison, A.R., *See* Turner, A.D., 14:30458
Juran, R., Test of NMR image quality affecting parameters, 14:32231 (RA;DD)
Jurka, J., β Turns in early evolution: chirality, genetic code, and biosynthetic pathways, 14:32118 (BA;US)
Just, R.A., *See* Bloom, S.G., 14:31907

K

Kabirova, G.M., *See* Solodukhin, V.P., 14:30379
Kachel, R., Importance of the complex radiological diagnosis for the decision on therapeutical treatment of malformations of cerebral blood vessels, 14:32333 (RA;DD;In German)
Kadar-Kallen, M. A., Focusing of particle beams using two-stage laser ablation, 14:32517 (J;US)
See Bonin, K. D., 14:32520
Kaellebring, B., *See* Larsson, S., 14:32178
Kaempfer, B., Correlations between dilepton yields and pion multiplicities as probe of the deconfinement transition, 14:32704 (R;DE)
Kafesjian, A.S., *See* Tyler, A.L., 14:30384
Kafka, R., Power plant performance monitoring and improvement: Volume 6, Economic dispatch optimization, 14:30794 (R;US)
Kahan, L., *See* Mani, S.A., 14:31711
Kaipetskaya, E.N., *See* Pechenkin, V.A., 14:31212
Kaiser, D., *See* Bittner, R., 14:32284
Kaita, R., *See* Levinton, F.M., 14:32882
Kakodkar, A., *See* Singh, R.K., 14:31653
Kale, T.L., *See* Jeffries, H.E., 14:31941, 14:31942
Kalender, W.A., New developments in measuring bone density by quantitative CT, 14:32339 (RA;DD;In German)
See Felsenberg, D., 14:32236
Kalia, R. K., *See* Loong, C., 14:31302
Kallman, J.S., *See* Clark, J.C., 14:31729
Kalmeyer, V., Theory of the spin liquid state of the Heisenberg antiferromagnet, 14:31371 (J;US)
Kalos, M.H., Computational methods for the nuclear and neutron matter problems: Progress report, 14:32700 (R;US)
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32701 (R;US)
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32702 (R;US)
Kalvach, P., Comparison of intraventricular and parenchymal brain hemorrhage in clinical and CT picture, 14:32330 (RA;DD)
Subcortical arteriosclerotic encephalopathy (SAE) in CT and clinical study, 14:32332 (RA;DD)
Kamae, T., Ballon-Borne experiments to study hard x-rays and gamma-rays from SN 1987 A, 14:31795 (RA;BR)
Kaminsky, S., Gd-DTPA - a positive oral contrast medium in abdominal MR tomography, 14:32234 (RA;DD;In German)
Kamm, K.F., Status and trends of digital image transmission and image storage, 14:32321 (RA;DD;In German)
Kammeraad, J., *See* Kasameyer, P., 14:32842
Kamperschroer, J.H., TFTR [Tokamak Fusion Test Reactor] neutral beam injected power measurement, 14:32928 (R;US)
Kampwirth, R. T., *See* Kim, D. H., 14:31310
Kan, I., *See* Finn, J. M., 14:32540
Kan, X. B., X-ray determination of the modulation potential in a stage-2 potassium-graphite intercalation compound, 14:31363 (J;US)
Kanary, D., *See* Babu, M., 14:30803
Kane, J. R., *See* Kuang, Y., 14:32526
Kaneko, M., *See* Hayashi, M., 14:30364
Kang, J., Fermi-level tuning in $Y_{1-x}U_xPd_3$, 14:31265 (J;US)
Kang, J. H., *See* Kim, D. H., 14:31310
Kang, M. H., *See* Lui, S., 14:31262
Kangas, M.T., Comparison of long-term aquifer thermal energy storage experiments to 3-D computer simulations, 14:30930 (RA;CA;In English and French)
Kangley, J.P., *See* Jacob, N.P., 14:30457
Kanivetsky, R., *See* Hoyer, M.C., 14:30946
Kannberg, L.D., Aquifer thermal energy storage in the United States, 14:30945 (RA;CA;In English and French)
See Vail, L.W., 14:30951
Kant, L., *See* Eisenberg, B.M., 14:32335
Kant, T., *See* Singh, R.K., 14:31653
Kantor, I.J., *See* Muralikrishna, P., 14:31799
Kanyar, B., *See* Almassy, Z., 14:32384
Kanzow, G., *See* Triebel, H.J., 14:32288
Kao, Y.K., *See* Yan, Z., 14:31438
Kapitulnik, A., *See* Urbach, J. S., 14:31313
Kaplan, S.D., *See* Witwer, C.R., 14:32405
Kappis, H.P., *See* Bartels, R., 14:30915
Kapulla, H., *See* Kraemer, R., 14:30477
Kapusta, J., Gauge-invariant correlation functions, 14:32643 (J;US)
Karady, G.G., New energy replacement method for resonant power supplies, 14:31755 (R;US)
Optimization of Resonant Power Supply Circuit, 14:31753 (R;US)
See Han, B.M., 14:31754
Karasaki, K., *See* Long, J.C.S., 14:32433
Karim, K. R., *See* Bhalla, C. P., 14:32523
Karlsson, G., Psychological aspects of nuclear waste disposal: Long time perception and the question of discounting of risks, 14:30606 (R;SE)
Karlsson, M., Gas composition of the freeboard gas in a fluidized bed boiler., 14:31584 (R;SE;In Swedish)
Karman, D., Thermal decomposition of New Brunswick oil shale, 14:30397 (RA;CN)
Karmanov, F.I., *See* Vasil'ev, Yu.O., 14:32656
Karol, P. J., *See* Tobin, M. J., 14:32671
Karplus, M., Molecular dynamics: applications to proteins, 14:32115 (BA;US)
Karr, T.J., Atmospheric effects on laser propagation, 14:33031 (R;US)
Kartachak, T., *See* Flanagan, G.F., 14:31167
Karunasagar, D., Rapid determination of burn-up of nuclear fuel - a possible approach, 14:31447 (J;US)
Kasameyer, P., A test of Newton's Law of Gravity using the BREN Tower, Nevada, 14:32842 (R;US)
Kasha, M., Energy transformation in molecular electronic systems: Comprehensive progress report, 1986–1989, 14:31472 (R;US)
Kashihara, H., *See* Matsubara, T., 14:30864
See Sasaki, N., 14:30501
See Yamamoto, M., 14:30491
Kaskey, J.A., *See* Priatko, G.J., 14:31678
Kasza, K.E., *See* Choi, U.S., 14:31136
Kathren, R.L., *See* Swint, M.J., 14:32372
Kato, I., *See* Laskowski, M. Jr., 14:32132
Kato, N., *See* Sugiyama, Y., 14:32667

Katoh, K., Critical comments on the current system of radiation protection and suggestions for improvement, 14:32768 (RA;AT)
Katsouleas, T., *See* Wilks, S. C., 14:31710
Kattat, V., Commercial zonation of the Estonia oil shale deposit, 14:30334 (RA;CN)
Katz, E.M., *See* Kevlin, T.W., 14:31880
Katz, L. F., *See* Angel, S. M., 14:31356
Kaufman, W. A., QCD effects in the B^0-B^{-0} system, 14:32610 (J;US)
Kaul, A., *See* Schwarz, E.R., 14:32350
Kaul, L.W., *See* Theis, T.L., 14:32048
Kaushik, S., *See* Hagelstein, P.L., 14:31634
Kawai, H., *See* Nishiwaki, Y., 14:30992
Kawakami, M., *See* Nishino, H., 14:30486
Kawazumi, H., Laser-based photoacoustic densitometer for two-dimensional scanning of thin-layer chromatographic plates, 14:31881 (J;US)
Kay, B. D., *See* Lykke, K. R., 14:32807
Kay, P.S., Implications of intermolecularly catalyzed reactions by the Tetrahymena ribozyme, 14:32094 (BA;US)
Kazahov, L.E., Measurement of the neutron radiative capture cross-sections for /sup 236/U and /sup 197/Au in the 3-420 keV energy range, 14:32687 (RA;XA)
Kazakov, L.E., *See* Kononov, V.N., 14:32686
Kazarezov, I.V., *See* Grishanov, B.I., 14:31749
Kazaritskij, V.D., Computer experiment for 3.65 GeV proton beam with a lead target for comparison of the MARS4 and HETC computer codes, 14:30842 (R;SU;In Russian)
Keane, C.J., *See* Bourgade, J.L., 14:31179
Keck, J.G., *See* Lai, M.M.C., 14:32112
Keefe, D., HIF/HIFAR accomplishments: A synopsis (December 1988), 14:32925 (R;US)
Keegstra, K., The role of transit peptides in the localization of chloroplastic proteins: Progress report, 14:32172 (R;US)
Keeley, J.F., International Atomic Energy Aagency safeguards: observations on lessons for verifying a chemical weapons convention, 14:31171 (R;CA)
Keh-Fei Liu, On the identification of θ ($f_2(1720)$) as a tensor glueball, 14:32595 (J;US)
Keller, G., *See* Schuetz, M., 14:32010
Keller, R., Magnetic properties of the ALS [Advanced Light Source] booster synchrotron engineering model magnets, 14:31761 (R;US)
Keller, T., Studies of cardiac protection by anti-ischemic and cytoprotective drugs, resp., using /sup 31/P-NMR spectroscopy, 14:32267 (RA;DD;In German)
See Buchali, K., 14:32265
See Dannhauer, K.H., 14:32268
See Ellermann, J., 14:32266
See Gruender, W., 14:32271
Keller, W., *See* Frendewey, D., 14:32105
Kelly, P.N., *See* Sanders, L.N., 14:30616
Kelman, A., *See* Lewosz, J., 14:30704
Keltner, N. R., *See* Gregory, J. J., 14:31683
Keltner, N.R., Heat transfer in severe accident simulations, 14:30601 (R;US)
Kemkes, B.M., *See* Rienmueller, R., 14:32279
Kendrick, M.A., *See* Lainhart, W.S., 14:30284
Keng, K., *See* Parker, J.C., 14:30974
Kennedy, P., *See* Flipot, A.J., 14:32904
Kennedy, S.T., Evaluation of a prototype air transport system for use in a crate handling and size reduction facility, 14:30449 (R;GB)
Kenny, P.W., Organized monolayers of polycyclic aromatic quinones, 14:31509 (J;US)
Kensek, R.P., *See* Stygar, W.A., 14:31873
Kent, J., Precision measurements of the SLC [Stanford Linear Collider] beam energy, 14:31778 (R;US)
See Levi, M., 14:31777
Keramati, B., Excitation-transfer collisions in cesium vapor: CS(5d (5/2)) + CS(6s (1/2)) yields CS(5d (3/2)) + CS(6s (1/2)), 14:32481 (R;US)
Kerekes, J., *See* Koeteles, G.J., 14:32386
Kerley, E.L., Mass and energy selective ion partitioning in a two-section Fourier transform ion cyclotron resonance spectrometer cell, 14:31398 (J;US)
Kerr, G., Pollutant evaluation, 14:31081 (R;CA;In English and French)
Kerur, B.R., Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
Ketcham, L., *See* Chao, Y., 14:31715
Ketoff, A., *See* Sathaye, J., 14:30996
Kettell, S., *See* Kuang, Y., 14:32526
Keuken, M.P., The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
Keung, W., *See* Chang, D., 14:32605
Kevlin, T.W., Proceedings of the industrial temperature measurement symposium, 14:31880 (B;US)
Keyes, C., Development of design guidelines and practices for improving residential service entrances, 14:30816 (R;CA)
Khriplovich, I.B., *See* Dolgov, A.D., 14:32825
Kibbey, A.H., *See* Godbee, H.W., 14:30474
Kiefer, H., Ideas for a practice-oriented radiation protection law, 14:30635 (RA;AT;In German)
Kienle, P., Status of the SIS/ESR-project at GSI, 14:31695 (R;DE)
Kier Nielsen, J., *See* Christensen, P., 14:30757
Kierzek, R., *See* Turner, D.H., 14:32092
Kikuche, J., *See* Nagata, K., 14:32473
Kikuchi, J., *See* Kohno, T., 14:32475
Kilbane, J. II, Microbial removal of organic sulfur from coal: Final report, October 1985–September 1988, 14:30262 (R;US)
Kilcher, P., *See* Roussiere, B., 14:32669
Kilcoyne, A. L. D., Comparative study of angle-resolved valence-band photoemission from half-monolayer structures of C, N, and O on Ni(100), 14:31259 (J;US)
Kilgore, D.C., *See* Roseberry, L.M., 14:32989
Killough, G.G., A model for global cycling of tritium, 14:32959 (J;US)
Kim, B., Interpretation of the optical properties of Nb, 14:31261 (J;US)
Kim, B.C., *See* Muralidhara, H.S., 14:31455
Kim, C. M., *See* Jeffries, C. D., 14:31307
Kim, C.H., Dynamic aperture of the ALS [Advanced Light Source] booster synchrotron, 14:31762 (R;US)
Kim, D., *See* Czernuszewicz, R.S., 14:31499
See Kuang, Y., 14:32526
Kim, D. H., Fluctuation conductivity of Tl-Ba-Ca-Cu-O thin films, 14:31310 (J;US)
Kim, I. C., *See* Lee, S. B., 14:32857
Kim, J. H., Assessment of Fermi-liquid description for the normal state of high-T_c superconductors, 14:32818 (J;US)
Kim, J.H., Electrochemical and Raman characterization of molecular recognition sites in self-assembled monolayers, 14:31520 (J;US)
See Kenny, P.W., 14:31509
Kim, P.S., *See* Shoemaker, K.R., 14:32116
Kim, S., *See* Wherle, R., 14:31785
Kim, S.S., *See* Wroblewski, A.E., 14:31497
Kim, T.H., Advanced gas separation membrane materials: rigid aromatic polyimides, 14:31427 (J;US)
Kim, W.Y., Source parameters of major earthquakes near Kiruna, Northern Sweden, deduced from synthetic seismogram computation, 14:32421 (R;SE)
Kim, Y., *See* Jeffries, C. D., 14:31307
See Saloman, E. B., 14:32514
Kimura, M., Subexcitation electrons in gas phase, 14:32489 (R;US)
See Kowari, K., 14:32755
Kincaid, C.T., *See* Vail, L.W., 14:30951
Kincaid, J.R., *See* Mallick, P.K., 14:31522
Kindle, C.H., Geothermal fluid sampling techniques, 14:30763 (RA;US)
King, M., *See* Kent, J., 14:31778
King, R.D., *See* Francis, G.A., 14:31098
King, R.J., Radiation from waves guided by nonuniform active surfaces, 14:32841 (R;US)
King, W.C., High resolution subsurface imaging with geophysical diffraction tomography, 14:32419 (R;US)
Kingdon, R.D., Modelling of MOSFET inversion layer conductivity using the resistor network method, 14:31861 (R;GB)
Kingman, A., *See* Seely, J. F., 14:31887
Kingon, A.I., The study of structure-processing-property relations in copper oxide-based high T_c superconductors: Progress report, July 1, 1988–March 1, 1989, 14:31278 (R;US)

Kinnison, D.E., Preventing depletion of stratospheric ozone: Implications on future aircraft emissions, 14:31973 (R;US)
Kirbie, H.C., Magnetic switching, 14:31783 (R;US)
See Haseroth, H., 14:31784
Kirchheim, R., *See* Mader, W., 14:31244
Kirchner, G., Estimation of the nuclide inventory of the Chernobyl core at the time of accident, 14:30846 (RA;AT)
Kirchner, H.P., Fracture mechanics of crack branching in ceramics, 14:31288 (BA;US)
Kirilyuk, A.L., Investigation of intermediate neutron interaction with tritium and hydrogen, 14:32653 (RA;SU;In Russian)
Kirk, H., *See* Boehnlein, A., 14:32564
See Chung, S. U., 14:32566
Kirk, P., *See* Naudet, C., 14:32659
Kirkham, I.A., *See* Angus, M.J., 14:30463
Kirkwood, S., SPECTRUM - a computer algorithm to derive the flux-energy spectrum of precipitating particles from EISCAT electron density profiles, 14:32478 (R;SE)
Kirsch, H., Automatic measuring station to monitor radioactive waste containers, 14:30630 (RA;AT;In German)
See Bergemann, L., 14:32773
Kiskis, J., Interpreting four-quark interactions in finite-temperature, SU(2), lattice gauge theory, 14:32641 (J;US)
Kissner, T.J., *See* Wieneke, R.E., 14:32935
Kisurin, V.A., *See* Berezin, F.N., 14:31819
Kiyashko, V.A., Ion induction accelerator with collective focusing (IINDUS), 14:31746 (RA;SU;In Russian)
Kjaer Jensen, S., *See* Schleisner Ibsen, L., 14:30960
Klasinc, L., Photoelectron spectroscopy of biologically active molecules. XVI. Benzophenone derivatives, 14:31397 (BA;US)
Klausner, J.C., Density of states of ordered and disordered superlattices, 14:32792 (RA;BR)
Kleih, J., *See* Koehne, R., 14:30756
Klein, A.J., *See* Streetman, K.D., 14:32999
Klein, K., Evaluation of two search radar systems for detection of ice masses, 14:31669 (R;CA)
Klein, M., *See* Williams, P., 14:32210
Klein, M. P., *See* Jeffries, C. D., 14:31307
Klein, S. A., *See* Seem, J. E., 14:31095
Klein, S. R., Λ_c^+ production and semileptonic decay in 29-GeV e^+e^- annihilation, 14:32574 (J;US)
Klenov, V.S., *See* Anikejchik, A.M., 14:31743
Klepatskij, A.B., Evaluated nuclear constants for uranium-236 (Preprint No. 2), 14:32690 (R;XA)
Klepko, V.V., *See* Ivanitskij, P.G., 14:32800
Klesment, I., *See* Luik, H., 14:30339
See Nappa, L., 14:30340
Kletter, K., Is there a measurably higher radiation risk for the personnel of a nuclear therapy station?, 14:32382 (RA;AT;In German)
Klevans, E.H., Use of zero and one dimensional RFP models to simulate behavior on ZT-40M and ZT-H: Quarterly progress report, 14:32866 (R;US)
Klima, B., *See* Hartouni, E. P., 14:32561
Kline, J.C., *See* Gladden, J.R., 14:31165
Klingmann, J., *See* Clark, J.C., 14:31729
Klinzing, G.E., *See* Chiang, Shiao-Hung, 14:30273
Klots, C.E., Evaporation from small particles, 14:31526 (J;US)
Klug, A., Zinc fingers: a novel protein fold for nucleic acid recognition, 14:32124 (BA;US)
Knapp, B., *See* Hartouni, E. P., 14:32561
Knauer, J., *See* Moreno, J. C., 14:32895
Knezovich, J.P., *See* McKone, T.E., 14:31094
Knieper, J., Radiation protection requirements on exhaust air installations of low-energy particle accelerators, 14:31698 (RA;AT;In German)
See Sauermann, P.F., 14:31700
Knight, L. V., *See* Gray, K. J., 14:31238
Knight, S., *See* Braenden, C.I., 14:32126
Knipmeyer, S.E., *See* Steele, W.V., 14:30313
Knizhnikov, V.A., *See* Buldakov, L.A., 14:30912
Knorovsky, G.A., *See* Cieslak, M.J., 14:31227
Knowles, J.R., *See* Hermes, J.D., 14:32138
Knox, J.B., Introduction to background materials for Workshop No. 1: Global climate change and its effects on California, 14:31971 (R;US)
Knudsen, P., Irradiation data for bump tests 1-11: Risoe Fission Gas Project: Revision, 14:30871 (R;DK)
Knudson, D.M., Fuel wood and charcoal research in the dominican republic. Results of the wood fuel development program, 14:30984 (R;DO)
Knudson, J. N., *See* Leitch, M. J., 14:32657
Knutsson, R., *See* Heino, P., 14:31031
Knyazev, B.A., 100-kJ microsecond REB transport in a one-meter solenoid, 14:32921 (R;SU;In Russian)
See Voropaev, S.G., 14:32874
Kobe, E., *See* Rosenkranz, G., 14:32225
Koblinger, L., Calculation on free-in-air kermas and effective dose equivalents from radioisotopes deposited on soil, 14:32767 (RA;AT)
See Andrasi, A., 14:32016
See Nagy, G., 14:31832
Kobzarev, K.K., *See* Kazaritskij, V.D., 14:30842
Koch, C.C., *See* Kingon, A.I., 14:31278
Koch, H.C., *See* Felsenberg, D., 14:32236
Koch, M., *See* Dewey, C., 14:32276
See Luening, M., 14:32222
Koch, R.D., *See* Gellerich, I., 14:32308
Kocher, D.C., *See* Killough, G.G., 14:32959
Koehler, J.T., [Visit to Bruker Analytische Messtechnik to expedite delivery of the AGS Booster Quadrupole Magnet Coils, Karlsruhe, W. Germany, February 16–March 4, 1989]: Foreign trip report, 14:31735 (R;US)
Koehler, K., *See* Tellkamp, H., 14:32246, 14:32247
Koehne, R., Performance of highly concentrating mirror collectors and collector systems, 14:30756 (R;DE;In German)
Koester, R., *See* Smailos, E., 14:30566
Koeteles, G.J., Thermography in diagnosis of local radiation injury, 14:32386 (RA;AT)
See Almassy, Z., 14:32384
Koetzle, T.F., *See* Yuan, H.S.H., 14:32355
Kogan, V. G., *See* Thiemann, S. L., 14:32817
Kohchi, T., *See* Ozeki, H., 14:32158
Kohno, F., *See* Hayashi, M., 14:30364
Kohno, T., Intensity maps of MeV electrons and protons below the radiation belt, 14:32475 (RA;BR)
See Nakamura, Y., 14:32474
Kohr, W.J., *See* Laskowski, M. Jr., 14:32132
Koike, J., *See* Meng, W.J., 14:31185
Kojdan, V.S., *See* Voropaev, S.G., 14:32874
Kolakofsky, D., Translational requirement for La Crosse virus S-mRNA synthesis, 14:32114 (BA;US)
Kolb, B.W., *See* Albrecht, R., 14:32706
Kolb, G.J., 16th inter-ram conference for the electric power industry, 14:30752 (R;US)
Kolbe, A.L., End-use evaluation, 14:31021 (RA;US)
Kollas, J.G., Assessment of the consequences of a research reactor credible accident release, 14:30913 (RA;AT)
Kolotyj, V.V., *See* Koval', G.N., 14:32763
Komarov, V.V. and others, *See* Vasil'ev, Yu.O., 14:32656
Kominsky, J.R., Health-hazard evaluation determination report No. 75-19-276, Masonite Corporation, Evendale, Ohio, 14:31959 (R;US)
Komnick, K., *See* Sauermann, P.F., 14:31700
Kompala, D.S., *See* Bynum, M.T., 14:30712
Kon'shin, V.A., *See* Antsipov, G.V., 14:32713
See Klepatskij, A.B., 14:32690
Konarksa, M.M., *See* Sharp, P.A., 14:32104
Konitzer, B., Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)
Konobeev, Yu.V., *See* Pechenkin, V.A., 14:31212
Kononov, V.N., Experimental determination of resonance self-shielding factors affecting the neutron radiative capture cross-section for /sup 238/U in the 10 to 140 keV energy range, 14:32686 (RA;XA)
See Kazahov, L.E., 14:32687
Konoto, Y., *See* Hebbard, D.F., 14:32695

Konrad, A., ENCORE-CANADA. Computer program for the study of energy consumption of residential buildings in Canada, 14:31070 (R;CA)
Koo, Y.M., *See* Keller, R., 14:31761
Kooij, A. van der, *See* Vries, W. de, 14:31833
Koontz, R.F., Anomalous electron loading in SLAC 5045 klystron and relativistic klystron input cavities, 14:31774 (R;US)
See Allen, M.A., 14:31771
Koontz, S.L., *See* Cross, J.B., 14:31331
Koop, B.F., *See* Goodman, M., 14:32166
Koperski, J., Development of Australian radiation protection regulations in the mining and milling of radioactive ores, 14:30637 (RA;AT)
Radiation exposure of the public from operations of ranger uranium mines, 14:30639 (RA;AT)
Koplitz, B., *See* Xu, Z., 14:31563
Kornilov, E.A., *See* Kiyashko, V.A., 14:31746
Kornmesser, W., *See* Kaminsky, S., 14:32234
Korolev, G.G., *See* Androsenko, Kh.D., 14:32684
Koros, W.J., *See* Kim, T.H., 14:31427
Korsak, V.Ya. and others, *See* Gavrilyuk, V.I., 14:31822
Koshland, D.E. Jr., Evolution of catalytic function, 14:32078 (BA;US)
See Thorsness, P.E., 14:32141
Koska, W. A., *See* Bambade, P., 14:31730
Koske, P.H., Uranium recovery from seawater by adsorption, 14:31446 (J;US)
Kosola, J., Fault Location in the Finnish transmission network, 14:30813 (R;FI;In Finnish)
Koste, W.R., Steam generator chemical cleaning waste processing at Millstone Unit No. 2, 14:30543 (RA;US)
Kostelecky, V. A., *See* Fatyga, B. W., 14:32849
Kostic, N.M., *See* Ratilla, E.M.A., 14:31505
Kotel'nikov, I.A., Effect of magnetic system errors on the transport processes in long solenoids, 14:32920 (R;SU;In Russian)
See Astrelin, V.T., 14:31717
Kotel'nikova, G.V., *See* Sal'nikov, O.A., 14:32646
Kothekar, V., Possible mode of regulation of DNA transcription by steroid hormones: glucocorticoids, 14:32190 (BA;US)
Kotowski, M., Technical Abstracts, 1988, 14:31586 (R;US)
Kotrappa, P., Development of electret technology to measure indoor radon-daughter concentrations: Final report (Phase 1), 14:31064 (R;US)
Kotsubo, V., Vortex turbulence generated by second sound in superfluid ^{4}He, 14:32539 (J;US)
Koturovic, A.M., Fluctuations and accuracy of a digital exposure ratemeter, 14:31834 (RA;AT)
Kotwal, A., *See* Kothekar, V., 14:32190
Kouzes, R. T., *See* Mann, L. G., 14:32676
Koval', G.N., Dose rate and spectral parameters investigation of fast neutron beams in medico-biological complex of Kiev U-120 cyclotron, 14:32763 (RA;SU;In Russian)
See Bezdrobnaya, L.K., 14:32375
See Isaenko, V.I., 14:32762
Koval, C.A., Concentration and removal of nitrogen and sulfur containing compounds from organic liquids phases using electrochemically reversed chemical complexation, 14:30268 (J;US)
Kovar, D. G., *See* Beck, C., 14:32668
Kovarik, F.S., *See* Heller, J.P., 14:30291
Kowalewsky, H., Enclosure of radioactive materials. Regulations, standards and practical experience, 14:30638 (RA;AT;In German)
Kowari, K., Electron degradation and yields of initial products: V. Degradation spectra, the ionization yield, and the Fano factor for argon under electron irradiation, 14:32755 (J;US)
See Kimura, M., 14:32489
Kozak, J.J., *See* Politowicz, P.A., 14:31530
Kozak, V.R., *See* Goncharov, V.N., 14:32998
Kozanecki, W., *See* Bambade, P., 14:31730
Kraemer, A., *See* Frendewey, D., 14:32105
Kraemer, R., Management of cladding hulls and fuel hardware, 14:30477 (RA;US)
Kraeusslich, H.G., *See* Paul, A.V., 14:32110
Krajcar-Bronic, I., *See* Obelic, B., 14:30884
Kramer, F.R., *See* Priano, C., 14:32108
Kramer, G. J., *See* Lanen, J. B. J. M., 14:32660
Kramer, H.M., Regulations in the Federal Republic of Germany to ensure a satisfactory quality of radiation protection dosemeters, 14:32776 (RA;AT)
Kramer, J.F., *See* Jacob, N.P., 14:30457
Krasinski, J.S., *See* Band, Y.B., 14:31639
Krauch, T., *See* Benner, S.A., 14:32084
Krause, H. F., *See* Schulz, M., 14:32516
Krebs, G. F., *See* Naudet, C., 14:32659
Krebs, J.S., *See* Witwer, C.R., 14:32405
Krebs, K., *See* Clayton, R., 14:30810
Kreider, T.W., *See* Rej, D.J., 14:32923
Krein, G., *See* Henley, E. M., 14:32622
Kreisig, T., Measurements of regional cerebral blood flow (rCBF) using dynamic single-photon emission computed tomography (DSPECT): Definition of a generally acceptable normal range and follow-up checks after extracranial bypass surgery, 14:32343 (R;DE;In German)
Kreisler, M., *See* Hartouni, E. P., 14:32561
Krenelka, T.C., Methanol Bus Program data analysis report. Interim report, September 1987-June 1988, 14:31163 (R;US)
Kress, R.L., *See* Jansen, J.F., 14:31594
Kressel, H.Y., Integrated MRI/MRS, 14:32259 (RA;DD)
Magnetic resonance imaging in recurrent carcinoma of the pelvis and its differentation from fibrosis, 14:32295 (RA;DD)
Kretsinger, R.H., Calcium coordination and the calmodulin fold: divergent versus convergent evolution, 14:32127 (BA;US)
Kriedemann, E., *See* Rotte, K.H., 14:32319
See Stuerzer, I., 14:32314
Krishnan, G.N., Study of ammonia removal in coal gasification processes: Final report, 14:30249 (R;US)
Krishnan, K.M., Electron Energy-Loss Spectroscopy: Fundamentals and applications in the characterization of minerals, 14:31394 (R;US)
Microanalytical and structural characterization of optical materials by electron microscopy and related spectroscopies, 14:31283 (R;US)
Krishnan, R., *See* Piacitelli, G., 14:31953
Krishnaswamy, J., Thin-film deposition by a new laser ablation and plasma hybrid technique, 14:31359 (J;US)
Krivenkov, A.M., *See* Romanov, V.A., 14:31738
Krivskij, I.Yu., On canonical quantization of the electromagnetic field in terms of field strengths, 14:32633 (R;SU;In Russian)
Kroeger, W., How the emergency plans for reactor accidents should be revised, 14:30910 (RA;AT;In German)
Krogh, E., Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)
Krueger, E.H., *See* Konitzer, B., 14:32361
See Scholz, H., 14:32018
Krueger, L., *See* Konitzer, B., 14:32361
Krug, R.M., Transcription and replication of influenza virion RNA in the nucleus of infected cells, 14:32111 (BA;US)
Kruger, J., *See* Long, G. G., 14:31890
Krumbiegel, P., *See* Buchali, K., 14:32265
Krumhansl, J.L., A review of near field seawater-sediment interactions with application to the subseabed disposal of nuclear waste, 14:30578 (R;US)
Krumpelt, M., Systems analyses for high-temperature fuel cells, 14:31049 (BA;US)
Krupa, M.P., US Geological Survey publications on western tight gas reservoirs, 14:30314 (R;US)
Krupke, W.F., Semiconductor laser-diode-pumped solid-state lasers, status and future, 14:31644 (BA;US)
Krupnyj, G.I., Spectral and angular distributions of charged particles outside biological shielding of the 70 GeV Serpukhov accelerator, 14:31742 (R;SU;In Russian)
Kuang, Y., Formation of the negative muonium ion and charge-exchange processes for positive muons passing through thin metal foils, 14:32526 (J;US)
Kuang, Yunan, Observation of the negative muonium ion in vacuum, 14:32505 (R;US)
Kubodera, S., *See* Wisoff, P.J., 14:31641
Kubono, S., *See* Sugiyama, Y., 14:32667
Kuchta, R.D., *See* Fierke, C.A., 14:32142
Kuener, E.L., *See* McKeehan, E.R., 14:30478

Kuffel, E.G., *See* Filipy, R.E., 14:32376
Kugel, H.W., *See* Kamperschroer, J.H., 14:32928
See Levinton, F.M., 14:32882
Kuhn, R.J., Construction of a mutagenesis cartridge for poliovirus genome-linked viral protein: isolation and characterization of viable and nonviable mutants, 14:32197 (J;US)
See Paul, A.V., 14:32110
Kuhn, W.L., Process simulation and statistical approaches for validating waste form qualification models, 14:30572 (R;US)
See Hutcherson, M.N., 14:30508
Kulhanek, O., *See* Kim, W.Y., 14:32421
Kulla, D., *See* Campbell, R.D., 14:30902
Kuma, K., *See* Miyata, T., 14:32164
Kumar, K., *See* Kuang, Y., 14:32526
Kumar, S., *See* Singh, S., 14:32494
Kumshaev, S.B., Rastr-RT interactive graphics system for real time tasks, 14:31820 (R;SU;In Russian)
Kunde, D., *See* Rotte, K.H., 14:32319
Kunkel, R., Comparative measurements on 30 whole-body counters, 14:31843 (RA;AT;In German)
Kunz, A. B., *See* Pandey, R., 14:31372
Kupperman, D.S., Application of neutron diffraction to the measurement of internal residual strain in the constituents of advanced composites, 14:31316 (R;US)
Kupriyanov, A.S., *See* Bel'chenko, Yu.I., 14:31747, 14:32918, 14:32919
Kupsch, C., *See* Braeutigam, K.R., 14:31928
Kuriyama, K., Hall mobility of positive carriers in the semimetallic compound LiGa, 14:31264 (J;US)
Kuriyan, J., *See* Karplus, M., 14:32115
Kurnit, N.A., *See* Shimada, T., 14:31650
Kursawe, R., Contribution of computerized tomography to estimating severity of acute pancreatitis, 14:32253 (RA;DD;In German)
Kurth, W.S., *See* Gurnett, D.A., 14:32442
Kurtz, S. R., *See* Patel, D., 14:31364
Kurzeja, R.J., Dispersion of HT and HTO following an unplanned release of tritium to the atmosphere, 14:32957 (J;US)
Kusmiderski, J., CT in diastematomyelia and diplomyelia, 14:32302 (RA;DD;In German)
Kustom, R.L., The Aspun Project, 14:31694 (R;US)
Kuts, V.N., *See* Zhuk, N.A., 14:31821
Kutsaeva, L.C., *See* Dyachenko, P.P., 14:32689
Kutz, D., Comparison of various methods relating to radionuclide examination of the thyroid gland, 14:32345 (R;DE;In German)
Kuussaari, M., *See* Kosola, J., 14:30813
Kuz'min, S.V., Definition of adiabaticity of nonparaxial magnetic mirror, 14:32875 (R;SU;In Russian)
Kuz'minov, B.D., Neutron physics. Vol. 2, 14:32647 (R;SU;In Russian)
Kvaratshelia, T.M., *See* Chikovani, Z.E., 14:32586
Kvitvang, A., New method for the cleaning of drilling mud, 14:31690 (R;NO;In Norwegian)
Kwack, E. Y., *See* Venkateshan, S. P., 14:31684
Kwakman, J.H.J.M., *See* Tabak, H.F., 14:32097
Kwast, H., *See* Flipot, A.J., 14:32904

L

La Fianza, G., *See* Carotenuto, A., 14:30937
La Mon, K., *See* Judd, D.L., 14:32924
LaBauve, R.J., *See* Hermann, O.W., 14:30569
Lacy, N.H., *See* Tuohy, J.M., 14:32946
Ladam, V., *See* Menanteau, B.P., 14:32277
LaFontaine, H., Construction of a simplified wood gas generator for fueling internal combustion engines in a petroleum emergency, 14:30674 (R;US)
Lafyatis, G.P., *See* Martin, A.G., 14:32487
Lagin, L., *See* Kamperschroer, J.H., 14:32928
Lai, M.M.C., Coronavirus: a jumping RNA transcription, 14:32112 (BA;US)
Laichter, Y., *See* Ben-Shachar, B., 14:31840
Lainhart, W.S., Pneumoconiosis in Appalachian bituminous coal miners, 14:30284 (R;US)
Laitinen, T., *See* Kangas, M.T., 14:30930
Laity, D.S., Comparison between Chinese and Colorado oil shales, 14:30380 (RA;CN)
Lajtai, A., *See* Dyachenko, P.P., 14:32689
Lake, J., *See* Oakes, M., 14:32147
Lake, J.A., Prokaryotes and archaebacteria are not monophyletic: rate invariant analysis of rRNA genes indicates that eukaryotes and eocytes form a monophyletic taxon, 14:32161 (BA;US)
Lake, W.H., *See* Sanders, T.L., 14:31605
Lalante, D., Recycling of iron and steel. State of the situation, 14:31152 (R;CA;In French)
Lallemand, J., *See* Bertin, M., 14:32771
Lallier, E., *See* Naudet, C., 14:32659
Lam, D. J., *See* Shi, D., 14:31300
Lam, Q. H., *See* Jeffries, C. D., 14:31307
Lamarche, P.H., *See* Rossmassler, R.L., 14:32942
Lamarque, J.L., Computed tomography and MRI of the female pelvis, 14:32293 (RA;DD)
Lamb, J.D., *See* Izatt, R.M., 14:31428
Lamb, R., *See* Robinson, W.A., 14:32218
Lamberger, P.H., *See* Hedley, W.H., 14:32951
See Wieneke, R.E., 14:32935
Lambert, D.J., *See* Ronan, M.T., 14:31792
Lambert, M.E., Eukaryotic transposable elements as mutagenic agents, 14:32077 (R;US)
Lambertson, G., *See* Voelker, F., 14:31760
Lamond, A.I., *See* Sharp, P.A., 14:32104
LaMonica, L., *See* Nelson, T., 14:30610
Lancsarics, G., *See* Andrasi, A., 14:32016
Landabur P, J., *See* Alegria R, E., 14:32756
Landaud, G., *See* Naudet, C., 14:32659
Landowne, S., *See* Sugiyama, Y., 14:32667
Landron, C.O., *See* Baldwin, G.T., 14:31872
Landry, S. M., *See* Davis, R. J., 14:31304
Lanen, J. B. J. M., Electrodisintegration of ^{6}Li studied with the reaction ^{6}Li($e,e'p$), 14:32660 (J;US)
Lanford, W. A., *See* Ryerson, F. J., 14:32436
Lang, E., *See* Andrasi, A., 14:32016
Lange, T., *See* Sandring, K.H., 14:32278
Langer, J. S., *See* Carlson, J. M., 14:32424
Langer, M., *See* Sander, B., 14:32224
Langford, A. A., Window cleaning and fluorine incorporation by XeF_2 in photochemical vapor deposition, 14:31679 (J;US)
Langley, R.A., Wall conditioning in ATF [Advanced Toroidal Facility], 14:32899 (R;US)
Langner, G.H. Jr., *See* Martz, D.E., 14:31063
Laniado, M., *See* Kaminsky, S., 14:32234
See Sander, B., 14:32224
Lanier, R. G., *See* Mann, L. G., 14:32676
Lankford, J., Characterization of mechanical damage mechanisms in ceramic composite materials. Technical report, 23 May 1987-24 May 1988, 14:31314 (R;US)
Ianzos, E., Cancer of endometrium, stage I. Treatment and results, 14:32220 (RA;BR;In Spanish)
Lapalme, G., *See* Potrin, J.-Y., 14:31096
Lapedes, A., Application of neural networks and other machine learning algorithms to DNA sequence analysis, 14:32174 (R;US)
Lapenas, A.A., Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)
Lapikas, L., *See* Lanen, J. B. J. M., 14:32660
Lappa, D.A., *See* O'Connell, W.J., 14:30613
Laptev, A.B., Effect of thermal neutron acceleration by vibrationally-excited nitrogen molecules, 14:32749 (RA;SU;In Russian)
Larsen, B.T., *See* Konrad, A., 14:31070
Larsen, I.L., *See* Ashwood, T.L., 14:32038
Larsen, R.P., Future applications of engine ceramics: Factors influencing market opportunities, timing, and growth, 14:31157 (R;US)
Larson, D.B., Seismic coupling of nuclear explosions: Volume 1, 14:31904 (R;US)
Larson, M.M., Results of comparison testing of the General Electric and Westinghouse-Hittman compactors, 14:30544 (RA;US)
Larsson, K., *See* Noemmik, H., 14:32003

Larsson, P.E., Farming of rainbow trout in acidified waters. Environmental effects and production prospects, 14:32359 (R;SE;In Swedish)
Larsson, S., Long distance electron transfer, 14:32178 (BA;US)
Laschka, D., *See* Huebel, K., 14:32072
Laser, M., Juelich Incineration Process for the combustion of hazardous and low level radioactive waste, 14:30484 (RA;US)
Lasher, L.C., *See* Collins, E.D., 14:30459
Laskowski, M. Jr., Positive Darwinian selection in evolution of protein inhibitors of serine proteinases, 14:32132 (BA;US)
Lassau, R.T., *See* Tyrer, J.D., 14:31219, 14:31220
Lassinger, R.T., *See* Capone, R.L., 14:30800
Lastick, S., Simultaneous fermentation and isomerization of xylose to ethanol, 14:30669 (RA;US)
Lateur, M., *See* Levi, M., 14:31777
Lau, K.C., Aquifer thermal energy storage systems with two aquifers, 14:30929 (RA;CA;In English and French)
See Mirza, C., 14:30957
Lauber, A.M., Load management - A way of reducing the costs for electric demand at Gustavsberg VVS AB, 14:31115 (R;SE;In Swedish)
Laufer, A.H., *See* Fahr, A., 14:31567
Laughlin, R. B., *See* Kalmeyer, V., 14:31371
Lauhala, K.E., *See* Filipy, R.E., 14:32376
Laun, J., Pricing - the marketing facilitator, 14:31026 (RA;US)
Laurens, J.-M., Use of non-dimensional representation of the solute transport equations, 14:30534 (R;GB)
Lauterbach, I., *See* Tellkamp, H., 14:32247
Lauterbach, U., International intercomparison of environmental gamma dose-rate meters, 14:31829 (RA;AT)
Lavellee, D.K., *See* Cole, D.A., 14:32349
Lavielle, D., *See* Basmaji, P., 14:32789
Lavine, T.L., Transient analysis of multicavity klystrons, 14:31768 (R;US)
See Adolphsen, C.E., 14:31776
See Koontz, R.F., 14:31774
Lawless, E.W., Risk-assessment methodology for hazardous-waste management. Final report, 14:31126 (R;US)
Lawrence, M.J., *See* Hopky, G.E., 14:32439
Lawrence, N., Characteristics of ribonuclease P from various organisms, 14:32099 (BA;US)
Lawson, R.N., *See* Rohwein, G.J., 14:31674
Lawson, W. S., The Pierce diode with an external circuit. I. Oscillations about nonuniform equilibria, 14:32534 (J;US)
The Pierce diode with an external circuit. II. Chaotic behavior, 14:32535 (J;US)
Lazar, I., Interaction cross sections for multinucleonic processes in light nuclear systems, 14:32719 (R;RO;In Romanian)
Lazar, P., *See* Pack, R., 14:30876
Lazarova, I., Role of computer tomography in the diagnostics of some diseases of the orbit, 14:32318 (RA;DD)
Lazor, R.B., Weld overlay disbonding, 14:31232 (R;CA)
Le Diberder, F., Study of the e/sup +/e/sup -/ annihilation reaction into four leptons, 14:32634 (R;FR;In French)
Le Grand, J., Kerma rates and whole-body absorbed dose rates for immersion in a semi-infinite cloud, 14:32766 (RA;AT)
Leader, D.C., *See* Service, R.R., 14:30796
Leanz, G.F., *See* Benner, S.A., 14:32084
Leavitt, D.R., *See* Tyler, A.L., 14:30384
Lebedev, S.V., *See* Voropaev, S.G., 14:32874
Lebedev, V.N., *See* Krupnyj, G.I., 14:31742
LeBlanc, D., An investigation into the state-of-the-art of dielectric heating applications for lamination, 14:31121 (R;CA)
Leboeuf, J.N., *See* Charlton, L.A., 14:32862
See Lynch, V.E., 14:32863
Leboutet, H., *See* Dei-Cas, R., 14:31731
Ledoux, E., *See* Cacas, M.C., 14:30556
Lee, A.D., *See* Callaway, J.W., 14:31075
Lee, A.S., Dissociation of organic and mineral matrix of Maoming oil shale at low-temperature and ambient-atmosphere, 14:30337 (RA;CN)
Lee, C.K., *See* Paul, A.V., 14:32110
Lee, E.P., *See* Judd, D.L., 14:32924
Lee, G.K., Low NO/sub x//SO/sub x/ burner trials. CFB Gagetown, 14:31680 (R;CA)
Lee, J.R., *See* Baldwin, G.T., 14:31872
See Fehl, D.L., 14:31851, 14:31869
Lee, K.J., *See* Doh, J.Y., 14:30465
Lee, K.L., *See* Ronan, M.T., 14:31792
Lee, L., Residence time distributions for ETF pH adjustment system, 14:30539 (R;US)
Lee, L.L., *See* Cochran, H.D., 14:31493
Lee, L.M., *See* Moore, L.M., 14:31892
Lee, M.J., *See* Adolphsen, C.E., 14:31776
Lee, M.L., *See* Huang, E.C., 14:31461
Lee, N.E., *See* Woodward, J., 14:30720
Lee, R., Changes in business-as-usual forecasts in a petroleum trade model, 14:30301 (J;GB)
Lee, R.S., Simple models for electric gun operating characteristics, 14:31782 (R;US)
Lee, S. B., Random-walk simulation of diffusion-controlled processes among static traps, 14:32857 (J;US)
Lee, S.G., Fuel pool component sampler as an integral part of a direct assay waste characterization method, 14:30469 (RA;US)
Lee, T.D., Theoretical high energy physics: Progress report, May 1, 1988–April 30, 1989, 14:32582 (R;US)
Lee, T.J., *See* Yates, B.F., 14:31534
Lee, W.J., *See* Casper, R.M., 14:30822
Lee, W.W.L., *See* Light, W.B., 14:30567
Lee, Y. Y., A high intensity hadron facility, AGS II, 14:31708 (J;US)
Lee, Y.T., *See* Hintsa, E.J., 14:31560
Lee, Y.Y., *See* Abasaeed, A.E., 14:30728
Leeper, R.J., *See* Baldwin, G.T., 14:31872
See Fehl, D.L., 14:31851, 14:31869
Leewis, K., Viscosity effects in selected flux cored arc welding consumables, 14:31338 (R;CA)
Leewis, K.G., *See* Lazor, R.B., 14:31232
Leggett, R.D., Mixed oxide fuel development, 14:30850 (R;US)
Lehman, N., *See* Jukes, T.H., 14:32156
Lehmann, R., Differential diagnosis of intraspinal tumors by MRT, 14:32299 (RA;DD;In German)
See Haehnel, H., 14:32310
See Harms, L., 14:32301
Lehmberg, R., *See* Pronko, M., 14:32926
Lei, M., *See* Wang, Z., 14:30332
Leigh, J.R., Observation of sub-barrier fusion enchancement due to negative hexadecapole deformations, 14:32674 (R;AU)
Leigh, R.W., Cost reduction in absorption chillers: Phase 2, 14:31056 (R;US)
Leitch, M. J., $^{14}C(\pi^+,\pi^-)^{14}O$ reaction between 19 and 80 MeV, 14:32657 (J;US)
Leitch, M.J., *See* Byrd, R.C., 14:31824
Leite, J.R., *See* Alves, J.L.A., 14:32790
Leite, S.B., Review of unresolved resonance treatments in multigroup processing computer codes, 14:30862 (R;BR;In Portuguese)
Use of ETOG computer code for preparing the epithermal library of HAMMER with data from ENDF/B-IV, 14:32992 (R;BR;In Portuguese)
Leitner, D. M., *See* Feingold, M., 14:32856
Lele, S., *See* Sathaye, J., 14:30996
Lelik, F., *See* Koeteles, G.J., 14:32386
Lembege, B., Formation of double layers within an oblique collisionless shock, 14:32538 (J;US)
Lemmeke, L., Project for low-temperature storage of solar heat in Klippan, Sweden, 14:30959 (RA;CA;In English and French)
Lemons, D. S., Sharp boundary analysis of electrostatic flute modes, 14:32536 (J;US)
Lemus, R., *See* Frank, A., 14:32509
Lenkinski, R.E., *See* Kressel, H.Y., 14:32259
Lentz, J.E., *See* Sienkiewicz, C.J., 14:32952
Leo-Miza, L., *See* Ghosh, D., 14:31320
Leon, M., Three-body molecular formation in muon-catalyzed *d-t* fusion: The role of configuration mixing, 14:32519 (J;US)
Leonard, K.R., *See* Yonath, A., 14:32152
Leone, S.R., *See* Woodbridge, E.L., 14:31561
Leonov, A.M. and others, *See* Balakov, V.F., 14:31744
Lepage, G. P., *See* Bodwin, G. T., 14:32644

Lerner, R.A., *See* Tramontano, A., 14:32088
Lesk, A.M., *See* Chothia, C., 14:32117
Lester, K., *See* Bennett, P.C., 14:31610
Lester, M.I., *See* Berry, M.T., 14:31519
Letaw, J.R., Astronaut radiation exposure in low-earth orbit. Part 1. Galactic cosmic radiation, 14:32366 (R;US)
Contributions to the plenary meeting of cospar (Committee on Space Research) (27th) held in Helsinki, Finland 18-29 July 1988, 14:32365 (R;US)
Equations of cosmic-ray transport with distributed acceleration, 14:32443 (R;US)
Letson, T., *See* Bortoletto, D., 14:32573
Leuze, M.R., *See* Pettey, C.C., 14:32985
Levanon, H., *See* Angerhofer, A., 14:31565
Levendis, Y.A., *See* Eckert, H., 14:31511
Levi, M., Precision synchrotron radiation detectors, 14:31777 (R;US)
See Kent, J., 14:31778
Levin, A.E., Design and testing of a heated thermocouple liquid level probe, 14:30875 (R;US)
Levin, K., *See* Kim, J. H., 14:32818
Levine, M., *See* Cairns, E.J., 14:30971
LeVine, M.J., [Developments in data acquisition hardware and software, CERN, Geneva, Switzerland, Frankfurt W. Germany, Oxford, UK, April 4-15, 1989]: Foreign trip report, 14:31737 (R;US)
Levinsen, M.T., *See* Alstroem, P., 14:31324, 14:32829, 14:32830, 14:32831
See Andresen, J.E., 14:32816
Levinton, F.M., Measurement of the poloidal magnetic field in the PBX-M tokamak using the motional Stark effect, 14:32882 (R;US)
Levon, A.I. and others, *See* Berezin, F.N., 14:31819
Levy, H., *See* Akerlof, C., 14:32462
Levy, R.M., *See* Hirata, F., 14:31476
Levy, S.C., Reliability of Li/SO/sub 2/ cells for long life applications, 14:30963 (BA;US)
Lewandowski, E., *See* Walz, D.R., 14:31780, 14:31781
Lewis, M.A., Gas generation from the irradiation of mortar, 14:30524 (R;US)
Lewis, M.S., Barnwell disposal site issues - 1985, 14:30549 (RA;US)
Update on 1985 and future transportation issues, 14:30450 (RA;US)
Lewis, N.S., *See* Lunt, S.R., 14:31524
Lewosz, J., The role of proteolytic enzymes in degradation of plant tissues: Summary report, 14:30704 (R;US)
Li Huiyun, Flux weighted method for solution of stiff neutron dynamic equations and its application, 14:30896 (R;CN;In Chinese)
Li Xueli, Formation condition of the Lushan hot spring and its genesis, 14:32068 (RA;XA)
Li Zhangsu, Investigation of seepage under the Wenxiakou dam using radiotracer, 14:31992 (RA;XA)
Li, C., Economic assessment of the Fushun type commercial shale oil plant, 14:30413 (RA;CN)
Li, J.L., *See* Jeffries, H.E., 14:31939
Li, K.Y., Kinetics of the complexation of nickel (II) with 8-hydroxyquinoline in aqueous solution, 14:31488 (J;US)
Li, M., *See* Wang, Z., 14:30407
Li, M.S., *See* Basmaji, P., 14:32789
Li, S., *See* Cao, Z., 14:30382
See Wang, J., 14:30341
Li, W.H., Reconstruction of phylogenetic trees and estimation of divergence times under estimation of evolution, 14:32162 (BA;US)
Li, Wann-Quan, *See* Mahajan, S.M., 14:32867
Li, X., *See* Tian, G., 14:30404, 14:30406
See Yang, Q., 14:30375
Li, Y. S., *See* Wu, S. C., 14:31260
Lian, H., *See* Wang, Z., 14:30407
Lian, H.J., *See* Lee, A.S., 14:30337
Liang, E.P., Gamma ray bursts: Confrontation between theory and observational data, 14:32464 (R;US)
Liang, G., Ideas on the development of Maoming oil shale and shale oil industry, 14:30415 (RA;CN)
Liao, Z., Petroporphyrins in several oil shales, China, 14:30374 (RA;CN)
Liaw, B.Y., *See* Deublein, G., 14:31050
Libman, V.A., *See* Vertebnyj, V.P., 14:32691
Lichti, R. L., Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
Licina, G.J., Microbial corrosion: 1988 workshop proceedings, 14:30865 (R;US)
Liddell, K.C., Model for the recovery of titanium from mixtures of ilmenite and hematite by hydrochloric acid leaching, 14:31451 (J;US)
Liddington, R.C., *See* Perutz, M.F., 14:32133
Lieberenz, S., *See* Gursky, S., 14:32232
See Rockstroh, G., 14:32235
Lienau, P.J., Introduction, 14:30773 (RA;US)
Light, W.B., The effect of precipitation on contaminant dissolution and transport: Analytic solutions, 14:30567 (R;US)
Lii, M., The stress state close to a crack tip shielded by a dislocation array, 14:31246 (J;US)
Lim, C.S., Electric quadrupole moments of the first excited state of /sup 192/Os, 14:32679 (R;AU)
Lim, H. A., *See* Meirovitch, H., 14:31362
Limaye, D.R., Demand-side management audit: improving the estimates of DSM impacts, 14:31016 (RA;US)
Lin Ruifen, *See* Shen Minzi, 14:32056
See Wei Keqin, 14:32058
Lin, A.I., Lactobacillus leichmannii and Escherichia coli ribonucleotide reductases: chemical and structural similarities, 14:32137 (BA;US)
Lin, L. T., *See* Angel, S. M., 14:31356
Lin, M., *See* Sundaram, M.S., 14:30245
See Wang, X., 14:30398
Lin, M.C., *See* He, Y., 14:31585
Lin, M.S., *See* Premuzic, E.T., 14:30766
Lin, S. H., Theory of photoinduced intramolecular electron transfer in condensed media, 14:30746 (J;US)
Lin, S.H., Stark effect on dynamics and spectroscopy of isolated molecules, 14:31517 (J;US)
Lin, Y., *See* Dorfman, R.C., 14:31556
Lin, Z., Parity-violating one-loop function in lower-dimensional type-I string theory, 14:32625 (J;US)
Lincke, E., *See* Haseroth, H., 14:31784
Lincoln, D.E., The effects of atmospheric CO_2 on insect herbivores and their hosts plants: Progress report, 14:31924 (R;US)
Lindberg, L., Model B - a new process for solidification of ion-exchange resins and evaporation concentration, 14:30464 (RA;US)
Lindberg, M., *See* Bostroem, C.Aa., 14:31113
Lindblad, I.B., *See* Findahl, O., 14:30923
Lindelof, P.E., Observation of the i = 1/2 fractional quantum Hall plateau in AlGaAs/GaAs/AlGaAs selectively doped double heterostructures, 14:31330 (R;DK)
Quantum Hall effect and the electrostatic Aharonov-Bohm effect, 14:32832 (R;DK)
Linden, J.C., *See* Shiang, M., 14:30725
Linden, O., *See* Jerneloev, A., 14:32397
Lindenbaum, S. J., Glueballs in 2^{++} $\phi\phi$ final states, 14:32550 (J;US)
Lindenbaum, S.J., *See* Saulys, A.C., 14:31804
LindH, G.C., *See* Izatt, R.M., 14:31439
Lindman, N., Bark gasification at Vaeroe bruk, 14:30742 (R;SE;In Swedish)
Lindqvist, M., Mass distribution in the galactic centre estimated from OH/IR stars, 14:32460 (R;SE)
Lindqvist, Y., *See* Braenden, C.I., 14:32126
Lindsay, C.N., *See* Ellefson, R.E., 14:32955
Lineau, P.J., Industrial applications, 14:30782 (RA;US)
Linschitz, H., *See* Hurley, J.K., 14:31559
Linss, G., *See* Eisenberg, B.M., 14:32335
Lints, M.C., *See* DeFrees, J.A., 14:30323
Linzama, H., Acid lixiviation of phophorite minerals for uranium extraction, 14:30429 (R;BR;In Spanish)
Linzon, S.N., *See* McIlveen, W.D., 14:31997
Lipkin, H. J., Why is the $\Upsilon(3S)$ different?, 14:32623 (J;US)
Lippert, J., *See* Stuerzer, I., 14:32311
Lippmann, M.J., Geothermal field case studies that document the usefulness of models in predicting reservoir and well behavior, 14:30772 (R;US)

Lisboa, A.C.L., Development of an oil shale fines pyrolysis technology, 14:30350 (RA;CN)
Lisin, A.V., *See* Deruyter, H., 14:31772
Lissauer, D., *See* Debbe, R., 14:31803
List, R.S., *See* Arko, A.J., 14:31393
Littenberg, L. S., *CP*-violating decay $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$, 14:32609 (J;US)
Litvinskij, L.L., *See* Vertebnyj, V.P., 14:32691
Litwin, C., Link between microstability and macrostability of plasmas, 14:32893 (J;US)
Litzke, J., *See* Huebel, K., 14:32072
Liu Bingren, *See* Zhou Shunli, 14:31805
Liu Cunfu, Study of the groundwater origin in Hebei Plain with isotopic method, 14:32067 (RA;XA)
Liu Guangyao, Application of isotope method in ground water resources investigation, 14:32059 (RA;XA)
Liu Yuanfang, *See* Wu Younghui, 14:31574
Liu Yuren, Development of nuclear suspended sediment flux gauge HDD-1, 14:31815 (RA;XA)
Liu, A., Temperature dependence of the rate constants of the reactions of OH radicals with C_2H_2 and C_2D_2 at 1 atm in Ar and from 333 to 1273 K, 14:31528 (J;US)
Liu, B., *See* Fu, Z., 14:30399
Liu, C., *See* Chen, J., 14:30381
Liu, C.T., *See* McKamey, C.G., 14:31245
Liu, G., *See* Yang, J., 14:30368
Liu, J., *CP* violation in the two-generation version of left-right models, 14:32614 (J;US)
Liu, J.Z., *See* Arko, A.J., 14:31393
Liu, K.V., *See* Cha, Y.S., 14:30877
See Choi, U.S., 14:31136
Liu, R., *See* Arko, A.J., 14:31393
Liu, S.B., *See* Chmelka, B.F., 14:31508
Liu, X., *See* Ongstad, A.P., 14:31562
Livengood, C.D., Combined SO_2/NO_x control technologies, 14:30271 (R;US)
Livesey, E., *See* Glass, R.E., 14:31611
Lizier, J., MR diagnosis in vascular diseases, 14:32282 (RA;DD)
Lloret, J.L., *See* Rienmueller, R., 14:32279
Lloyd, R.C., Criticality experiments with a mixed oxide fuel pin array in plutonium-uranium nitrate solutions, 14:30440 (R;US)
Lloyd, W.R., Evaluation of elastic-plastic surface flaw behavior and related parameters using surface displacement measurements, 14:31195 (R;US)
Lo, S.H., *See* Tyrer, J.D., 14:31219, 14:31220
Lobzov, L.D., *See* Grebenyuk, S.V., 14:31745
Lochner, B., *See* Schuetz, H.J., 14:32331
Locquet, J., Discrete and continuous disorder in superlattices, 14:31263 (J;US)
Loddenkemper, R., *See* Bittner, R., 14:32284
Loehman, R.E., Ceramic joining in the United States, 14:31287 (R;US)
Loerch, T., *See* Wittler, C., 14:32387
Loeschhorn, U., Decommissioning of the Niederaichbach Nuclear Power Station (KKN) - remote dismantling, 14:30897 (RA;US)
Loevblad, G., *See* Calander, K., 14:31926
Loew, G., Energy-conformational studies of β-endorphins: identification of plausible folded conformers, 14:32181 (BA;US)
Loew, G.A., *See* Deruyter, H., 14:31772
See Wang, J.W., 14:31773
Lofy, P.T., *See* Hansel, H.C., 14:30692
See Poe, T.P., 14:30684
Logan, R., Minutes of the meeting, Metal Forming Modeling Subgroup of IMOG, February 1988, 14:31215 (R;US)
Lohman, P.H.M., *See* Buul, P.P.W. van, 14:32373
Lok, B.K., *See* Laity, D.S., 14:30380
Lok, C. K. C., *See* Wu, S. C., 14:31260
Lolis, E., *See* Alber, T.C., 14:32139
Lomachenkov, I.A., New formulas for systematics of total radiative widths of neutron resonances, 14:32730 (RA;SU;In Russian)
Long, G. G., Surface-extended x-ray-absorption fine-structure experiments at atmospheric pressure by means of a photocathode proportional counter with monolayer sensitivity, 14:31890 (J;US)
Long, G. L., *See* McCreary, T. W., 14:31402
Long, J.C.S., Characterization of fracture networks for fluid flow analysis, 14:32433 (R;US)
Longacre, R. S., Future opportunities for hadron spectroscopy at the MPS, 14:32567 (J;US)
Longacre, R.S., *See* Saulys, A.C., 14:31804
Longfellow, C.E., *See* Turner, D.H., 14:32092
Longmire, M.L., *See* Morita, M., 14:31553
Loo, J.A., *See* Udseth, H.R., 14:31403
Loong, C., High-energy oxygen phonon modes and superconductivity in $Ba_{1-x}K_xBiO_3$: An inelastic-neutron-scattering experiment and molecular-dynamics simulation, 14:31302 (J;US)
Lopes, L.R., *See* Canalini, A., 14:30869
Lopez G, J., *See* Dios L, M. de, 14:32822
Lopez, C.W., *See* Kolb, G.J., 14:30752
Lord, R.S., *See* Olsen, D.K., 14:31786
Lorence, L.J. Jr., *See* Baldwin, G.T., 14:31872
Lorenz, J.J., *See* Tamura, A.T., 14:30529
Lorimer, G., *See* Braenden, C.I., 14:32126
Lorinc, M., *See* Andrasi, A., 14:32016
Lorz, E, *See* Dewes, P., 14:30843
Lotritsch, K.H., Radiation burden in X-ray examinations of facial skull, 14:32351 (RA;AT;In German)
Lott, B., Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Loubriel, G.M., Closing photoconductive semiconductor switches, 14:31673 (R;US)
See Zutavern, F.J., 14:31672
Louis-Jacquet, M., *See* Bourgade, J.L., 14:31179
Lovchikova, G.N., *See* Sal'nikov, O.A., 14:32646
Love, W.A., *See* Saulys, A.C., 14:31804
Lovins, A.B., Least-cost planning: profiting from the negawatt revolution, 14:31009 (RA;US)
Lowenstein, D. I., *See* Lee, Y. Y., 14:31708
Lowson, R.T., Rum Jungle tailings dam - chemical profile of the subsoil, 14:30620 (R;AU)
Lozano, A., *See* Sabate, J., 14:32213
Lu Jieju, *See* Gu Weizu, 14:31993
Lu Mingjiang, *See* Gu Weizu, 14:31993
Lu Yanxin, *See* Liu Yuren, 14:31815
Lu, D. C., *See* Kuang, Y., 14:32526
Lu, G., *See* Fu, Z., 14:30399
Lu, G. Q., Interferometric measurement of the pressure-enhanced crystallization rate of amorphous Si, 14:31361 (J;US)
Lu, Q., Isothermal pyrolysis gas chromatography for study of hydrocarbon formation kinetics from kerogens, 14:30345 (RA;CN)
Lu, S., Study on the kinetics of kerogen pyrolysis by means of pressure differential scanning calorimetry, 14:30385 (RA;CN)
Thermal properties of Chinese oil shale - measurement of thermal conductivity of oil shale, 14:30377 (RA;CN)
Lu, T., Raman and surface-enhanced Raman study of asymmetrically substituted viologens, 14:31542 (J;US)
Lubaszewski, R., *See* Lee, S.G., 14:30469
Lucan, M., *See* Georgescu, S.A., 14:32291
Lucas, R.P. Jr., Community Radiation Monitoring Program annual report, October 1, 1987–September 30, 1988, 14:31982 (R;US)
Lucchetti, G., *See* Beyer, J.M., 14:30682
Lucchetti, G.L., Prototype water reuse system, 14:30691 (RA;US)
Luchini, K., *See* Keller, R., 14:31761
Lucki, G., Radiation effects on metals, alloys and cement, 14:31200 (RA;BR)
Radiation effects on metals, alloys and cement, 14:31213 (R;BR)
Ludeke, R., *See* McLean, A. B., 14:31377
Ludlam, T., *See* Debbe, R., 14:31803
Ludwig, G.O., *See* Ferreira, J.L., 14:32781
Ludwig, S.B., *See* McBride, A.F., 14:30571
Luening, M., Comparison of imaging procedures in the diagnosis of expanding processes of the liver, 14:32222 (RA;DD;In German)
See Bickhardt, J., 14:32285
See Dewey, C., 14:32276, 14:32292
See Kursawe, R., 14:32253
See Planitzer, J., 14:32275
See Sandring, K.H., 14:32278, 14:32281
Luensmann, W., *See* Huebel, K., 14:32072

Luft, W., High-rate deposition of hydrogenated amorphous silicon films and devices, 14:30745 (J;US)
Plasma deposition of hydrogenated amorphous silicon films, 14:30744 (J;US)
Lui, A., Studies on gas transport through dry cellulose acetate membranes prepared by solvent exchange technique, 14:31441 (J;US)
See Fouda, A.E., 14:31457
Lui, S., Surface states on NiAl(110), 14:31262 (J;US)
Luik, H., Liquefaction of oil shales in different solvents and reagents, 14:30339 (RA;CN)
Luisi, B., *See* Perutz, M.F., 14:32133
Luna, R.E., *See* McClure, J.D., 14:30596, 14:30597
Lund, I., *See* Albrecht, R., 14:32706
Lund, P.D., *See* Kangas, M.T., 14:30930
Lundin, S.-E., Thermal energy storage programme in Sweden, 14:30987 (RA;CA;In English and French)
Lunev, V.P., *See* Ignatyuk, A.V., 14:32728
Lunis, B., Environmental considerations, 14:30767 (RA;US)
Lunis, B.C., Demonstration projects lessons learned, 14:30774 (RA;US)
Lunt, S.R., Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces, 14:31524 (J;US)
Luo, C., *See* Guo, S., 14:30354
Luo, H., *See* Gerward, L., 14:31328
See Staun Olsen, J., 14:31329
Luo, R., Reactor-combustor fluidized bed retorting of Maoming oil shale, 14:30349 (RA;CN)
See Wang, Z., 14:30407
Lusem, H., Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu, 14:32502 (RA;BR)
Lutsko, J.F., High-temperature behavior of grain boundaries from embedded atom method molecular dynamics simulation, 14:31188 (R;US)
Luttschwager, L., *See* Zur, C., 14:32242
Luu, L., *See* Alexander, J.H., 14:30838
Lykke, K. R., Rotationally inelastic scattering of N_2 from clean and hydrogen covered Pd(111), 14:32807 (J;US)
Lyman, C.E., Analytical electron microscopy of catalyst promoters, poisons, and active species: Progress report, [July 1986–September 1988], 14:31470 (R;US)
Lyman, J. L., Thermodynamic Properties of Dioxygen Difluoride (O_2F_2) and Dioxygen Fluoride (O_2F), 14:31486 (J;US)
Lyman, J.L., Oxygen fluoride chemical kinetics, 14:31547 (J;US)
Lynch, D. W., *See* Kim, B., 14:31261
Lynch, F., Safety evaluation of a prototype hydride-powered underground-mining vehicle. Final report, May 1984-May 1987, 14:32410 (R;US)
Lynch, V.E., Equilibrium and ideal stability studies for ATF, 14:32863 (R;US)
See Cary, J.R., 14:32900
See Charlton, L.A., 14:32862
Lyneis, C.M., *See* Clark, D.J., 14:31758
Lynn, J.E., Fission theory: Its relevance to the nuclear cross section data base, 14:32696 (R;US)
Lysaght, P.S., *See* Wilhelmy, J.B., 14:32681
Lyutostanskij, Yu.S., Nucleosynthesis in the fast neutron capture processes, 14:32457 (RA;SU;In Russian)

M

Ma, W. C., *See* Beck, C., 14:32668
Ma, X., Geological types of oil shale deposits in China, 14:30328 (RA;CN)
Ma, Y. J., *See* Sette, F., 14:31367
Maas, R., *See* Spielmann, R.P., 14:32280
MacArthur, D.W., Wire chamber assembly techniques: More methods, 14:31823 (R;US)
Macauley, G., *See* Ball, F.D., 14:30330
MacCallum, C., *See* Akerlof, C., 14:32462
MacCracken, M.C., Climate projections with regional resolution, 14:31976 (R;US)
MacDonald, J.M., Investigation of metered data analysis methods for commercial and related buildings, 14:31071 (R;US)
MacDonald, R., *See* Pon, C.J., 14:30815
MacDonell, M.M., *See* Peterson, J.M., 14:32026
Macedo, P.B., Long term leach behavior of West Valley HLW glasses, 14:30510 (RA;US)
See Feng, X., 14:30522
See Finger, S.M., 14:30506
Macek, J., Strong potential wave functions with elastic channel distortion, 14:32524 (J;US)
Macek, R.J., The proton storage ring: Problems and solutions, 14:31788 (R;US)
MacGowan, B.J., *See* Bourgade, J.L., 14:31179
Machilek, R., *See* Clayton, R., 14:30810
Macken, J., Compact diffusion-cooled CO/sub 2/ laser, 14:31649 (BA;US)
MacKenzie, D.R., *See* Cowgill, M.G., 14:30455
Mackenzie, G.A., *See* Christiansen, H., 14:32002
MacLaughlin, D. E., *See* Heffner, R. H., 14:31252
MacLeod, D.M, The electrical characteristics of wood poles, 14:32404 (R;CA)
MacLeod, D.M., Steam substitution in chemical process, petrochemical and petroleum industries, 14:31130 (R;CA)
Macor, K.A., *See* Czernuszewicz, R.S., 14:31499
MacPherson, L.J., *See* Benner, S.A., 14:32084
Mader, W., Modulating the composition of a metal/oxide interface and using hydrogen as a probe, 14:31244 (J;US)
Madland, D.G., Theory of neutron emission in fission, 14:32737 (R;US)
Madsen, M.M., A method for evaluating structural transducers used in Type B package testing, 14:30592 (R;US)
Design verification testing, 14:30591 (R;US)
Maeda, K., Inflation in a renormalizable cosmological model and the cosmic no-hair conjecture, 14:32467 (J;US)
Maeda, M., *See* Yamamoto, M., 14:30491
Maerefat, N., *See* Honarpour, M., 14:30293
Maggi, R., *See* Aldape, F., 14:31906
Maguire, C. F., *See* Beck, C., 14:32668
Mahajan, S.M., Equilibrium of a plasma in the fluid- and Vlasov-Maxwell systems, 14:32867 (R;US)
Maher, C., *See* Beise, E. J., 14:32658
Maholland, M.K., *See* Ratcliff, M.A., 14:30735
Mahoney, J.L., Pilot plant demonstration of the Defense Waste Processing Facility (DWPF) melter concepts, 14:30502 (RA;US)
Maiden, D., Viscosity of solids determined by shock wave action on hemispherical indentations, 14:31897 (R;US)
Maier, K.H., *See* Roy, N., 14:32682
Maillet, J., *See* Jouan, A., 14:30497
Mainardi, R.T., Influence of the beam aperture on the Compton line profile, 14:32501 (RA;BR)
Maiorino, J.R., *See* Bitelli, U.D., 14:30889
Mairson, R.C., *See* Wheeler, B.R., 14:30505
Maison, J.M., *See* Fortier, S., 14:32664
Maizels, N., Peptide-specific ribosomes, genomic tags, and the origin of the genetic code, 14:32153 (BA;US)
Majer, E.L., *See* Long, J.C.S., 14:32433
Majid, I., Evidence against the existence of strong diffuse x-ray scattering from gold twist boundaries at room temperature, 14:32786 (R;US)
Majors, P.D., *See* Givler, R.C., 14:31657
Majumdar, S., *See* Kupperman, D.S., 14:31316
Maka, A., *See* Kilbane, J. II, 14:30262
Makino, S., *See* Lai, M.M.C., 14:32112
Makov, Yu.N., *See* Afanasiev, V.L., 14:32455
Makowiecki, D., *See* Debbe, R., 14:31803
Makowski, M.A., *See* Stallard, B.W., 14:32886
Mal'tsev, A.A., *See* Golutvin, I.A., 14:31750
Malavolta, E., Isotopes and agriculture, 14:32358 (R;BR;In Portuguese)
Malecki, B., *See* Shi, D., 14:31300
Malev, M.D., *See* Weisser, D.C., 14:31862
Malevannyj, S.V., *See* Lyutostanskij, Yu.S., 14:32457

Maley, M.P., *See* Arendt, P.N., 14:30811
Malhotra, V.M, *See* Sivasundaram, V., 14:31111
Malinauskas, A.P., *See* Rashid, Y.R., 14:30586
See Sanders, T.L., 14:31606
Malinovskij, V.V., Evaluation of the energy dependence of the average number of prompt neutrons 4u-bar p for neutron-induced fission of /sup 235/U in the 0-20 MeV energy range, 14:32685 (RA;XA)
Mallek, H., *See* Laser, M., 14:30484
Mallick, P.K., Vibrational spectra and normal-coordinate analysis of tris(bipyridine)ruthenium(II), 14:31522 (J;US)
Mallinson, L.G., *See* Reed, D.L., 14:30554
Malone, T., *See* Edmonds, J., 14:31920
Malow, G., Characterization and comparison of highly radioactive and simulated glass and glass ceramic waste forms, 14:30511 (RA;US)
Maltman, K., Inevitable dibaryons, 14:32599 (J;US)
Malvicini, A., *See* Dominici, G., 14:31983
Mamich, S.T., *See* Martz, D.E., 14:31063
Manheimer, W. M., *See* Fliflet, A. W., 14:31889
Mani, S.A., Assessment of a novel r-f linac amplifier concept. Final report, June 1987-July 1988, 14:31711 (R;US)
Manjoine, M.J., Fatigue life prediction for a cold worked T316 stainless steel, 14:31201 (R;BR)
Manka, C., *See* Pronko, M., 14:32926
Manley, D.L., *See* Bowlen, K.L., 14:31073
Mann, K.L., *See* Zimmerman, R.M., 14:30589
Mann, L. G., $^{148}Gd(p,t)^{146}Gd$ reaction: Neutron states in ^{146}Gd, 14:32676 (J;US)
Mann, L.G., *See* Roy, N., 14:32682
Mannik, L., *See* Woodall, K.B., 14:30439
Mannil, R., *See* Puura, V., 14:30331
Manohar, M., *See* Wilde, B.E., 14:31236
Mansard, B., *See* Bailly, H., 14:30848
Manson, J. R., *See* Zheng, X., 14:32815
Manson, S., Photoabsorption and photoionization cross sections: an overview of the current state of knowledge, 14:32484 (R;US)
Photoionization cross sections of positive ions, 14:32485 (R;US)
Manson, S.T., Photoionization of Al^+ ions: a relativistic random phase approximation study, 14:32486 (R;US)
Mansour, N. B., Laser-rf double-resonance measurements of the hyperfine structure in Sc ii, 14:32521 (J;US)
Manzanares, M.M., *See* Denison, G.J., 14:32931
Mao, H. K., *See* Hemley, R. J., 14:31370
Maple, M. B., *See* Kang, J., 14:31265
Maragliano, A., *See* Pizzuto, A., 14:32911
March, N.H., *See* Amato, M.A., 14:32803
Marchal, G., *See* Baert, A.L., 14:32328
Marchand, C., Study of the electromagnetic response functions and momentum distributions of large linear momentum protons in the helium-3 nucleus using inelastic electron scattering, 14:32651 (R;FR;In French)
Marchon, B., Observation of graphitic and amorphous structures on the surface of hard carbon films by scanning tunneling microscopy, 14:31376 (J;US)
Relative and kinetic properties of carbon monoxide and carbon dioxide on a graphite surface, 14:31523 (J;US)
Marciniak, R., CT in different types of tumors of the nasopharynx and of the paranasal sinuses, 14:32258 (RA;DD;In German)
See Bem, Z., 14:32297
See Sharp, P.A., 14:32104
Marcinow, Z., Metal-ammonia reduction of α-tetralone. Competition between ring reduction, carbonyl reduction, and dimer formation, 14:31495 (J;US)
Metal-ammonia reduction of triphenylene, 14:31496 (J;US)
Marcus, C., *See* Menanteau, B.P., 14:32277
Margrita, R., *See* Calmels, P., 14:30557
Marianer, S., Low-field Hall effect near the percolation threshold, 14:31255 (J;US)
Marie, J.-P., *See* Boileau, Y., 14:30948
Marietta, M.G., Low-Level Waste Ocean Disposal Program final report: Site characterization of the Pacific Study Area, West Coast, Northern Site (W-N), 14:30577 (R;US)
Marion, J.E., Fracture mechanisms of solid state slab lasers, 14:31647 (BA;US)
Markides, K.E., *See* Huang, E.C., 14:31461
Markovic, P., Back scattering coefficients for 50 to 400 kV X-rays scattered on baryt concrete, 14:32750 (RA;AT)
Marks, S., *See* Keller, R., 14:31761
Markstroem, I., *See* Pusch, R., 14:30608
Markwardt, J., Comparison of NMR imaging and scintigraphic findings in malignant bone tumors, 14:32315 (RA;DD;In German)
Marlow, K.W., *See* Scott, H.L., 14:32692
Marlowe, C.K., *See* Bartlett, P.A., 14:32087
Maroni, V. A., *See* Johnson, S. A., 14:31415
Maroni, V.A., *See* Melendres, C.A., 14:31271
Marques, G.E., *See* Aladim, S.R., 14:32823
Marr, R., *See* Ruppert, M., 14:31429
Marr, W.W., Optimization of battery characteristics for urban electric van applications, 14:30964 (BA;US)
Marsh, G.E., Simplified anti-submarine warfare problem treated as a steady state Markov process, 14:33015 (J;US)
Marsh, G.P., Progress in the assessment of the corrosion of low and intermediate level waste containers under repository conditions, 14:31218 (R;GB)
Marsh, L.E., Evidence implicating a tRNA heritage for the promoters of positive-strand RNA synthesis in brome mosaic and related viruses, 14:32109 (BA;US)
Marshall, M., *See* Parker, R.C., 14:31587
Marshall, T., *See* Blessing, S., 14:32559
See Chung, S. U., 14:32566
Marsily, G. de, *See* Cacas, M.C., 14:30556
See Cacas, M.C., Ledoux, E., 14:30558
Martens, P., Experimental investigation of regulating systems for combinations of solar collectors and heat pumps, 14:30750 (R;DK;In Danish)
Martin, A.G., R-f spectroscopy of trapped neutral atoms, 14:32487 (R;US)
Martin, G., *See* Bellon, P., 14:31181
Martin, J., *See* Adams, J., 14:33013
Martin, J.A., *See* Cross, J.B., 14:31331
Martin, J.D., *See* Joy, D.S., 14:30523
Martin, J.K., *See* Yang, J., 14:31155
Martin, W., *See* Haigh, C.P., 14:30479
Martinez, D.P., VMS [Virtual Memory Systems] ALAP [Audit Log Analysis Package] 1.0: An automated audit trail analysis tool, 14:33002 (R;US)
Martinez, E., Impact of regulations on operation of a LLW burial site, 14:30541 (RA;US)
Martins, A.H., Obtainment of sodium vanadate in sulfuric medium, 14:31386 (R;BR;In Portuguese)
Martins, R., Analysis of elements produced in TCDDC system by mass spectrometry, 14:31387 (RA;BR;In Portuguese)
Martz, D.E., Validation of the diffusion-barrier charcoal canister method, 14:31063 (R;US)
Marxsen, A., *See* Ordonez, S., 14:31210
Masarwa, M., Reactions of low-valent transition-metal complexes with hydrogen peroxide. Are they Fenton-like or not? 1. The case of Cu^{+}_{aq} and Cr^{2+}_{aq}, 14:31501 (J;US)
Maschhoff, B.L., *See* Nebesny, K.W., 14:31464
Maskarinec, M.P., *See* Griest, W.H., 14:31444
Maslennikov, V.M., *See* Vyskubenko, Yu.A., 14:30402
Maslov, V.M., *See* Antsipov, G.V., 14:32713
See Klepatskij, A.B., 14:32690
Maslyaev, P.F., *See* Koval', G.N., 14:32763
Mason, C.F.V., The future of Chinese science, 14:30988 (R;US)
Mason, M., *See* Bennett, P.C., 14:31610
Massolo, C.P, *See* Fortier, S., 14:32664
Massuda, M., Filtration behavior of slurries with varying compressibilities, 14:31456 (J;US)
Masters, M., *See* Keramati, B., 14:32481
Mastin, G. A., *See* Sanford, T. W. L., 14:32888
Mastin, G.A., *See* Ghiglia, D.C., 14:31608
Masuda, T., *See* Hayashi, M., 14:30364
Masyanov, S.M., *See* Anufriev, V.A., 14:32675
Mata, R., Jr., *See* Gregory, J. J., 14:31683
Mataloni, P., *See* Canonico, A., 14:30490

Mataya, M.C., Effects of multiple reductions on grain refinement during hot working of alloy 718, 14:31225 (R;US)
See Weis, M.J., 14:31226
Mathew, D., *See* Fee, E.J., 14:32028
Mathews, C.K., *See* Nayak, S.K., 14:30447
See Srinivasan, T.G., 14:30445
Matkowsky, B.J., *See* Bayliss, A., 14:31273
Matlock, D.K., *See* Mataya, M.C., 14:31225
See Weis, M.J., 14:31226
Matsubara, T., Radiation effects on fiberoptic signal transmission systems, 14:30864 (RA;US)
Matsui, M., *See* Nishino, H., 14:30486
Matsuki, T., Consistency of quantum cosmology for models of plane symmetry, 14:32468 (J;US)
Matsumoto, T., *See* Lloyd, R.C., 14:30440
Matsushima, K., *See* Oppenheim, J.J., 14:32364
Matsuura, T., *See* Fouda, A.E., 14:31457
See Lui, A., 14:31441
Matteman, J.L., KEMA incinerator for radioactive waste, 14:30487 (RA;US)
Matthews, C.K., *See* Karunasagar, D., 14:31447
Matthews, C.R., *See* Stackhouse, T., 14:32131
Matthews, D.L., *See* Bourgade, J.L., 14:31179
Matthews, H.E., *See* Lindqvist, M., 14:32460
Matthews, S.K., *See* MacArthur, D.W., 14:31823
Mattison, T.S., *See* Adolphsen, C.E., 14:31776
Mattsson, O., *See* Schrire, D., 14:30832
Matzen, M.K., *See* Hussey, T.W., 14:31631
Mau Hsiung Chen, Atomic *K*-, *L*-, and *M*-shell cross sections for ionization by protons: A relativistic Hartree-Slater calculation, 14:32511 (J;US)
Mauney, J., *See* Agrawal, D.P., 14:32976
Maushart, R., Radiation protection instruments and methods - today and tommorrow, 14:31827 (RA;AT;In German)
Max, C.E., Computer simulations of cosmic-ray diffusion near supernova remnant shock waves, 14:32463 (R;US)
May, E., *See* Capone, R.L., 14:30800
Mayberry, M.J., 60 MHz fast wave current drive experiments for DIII-D, 14:32871 (R;US)
See Pinsker, R.I., 14:32870
Mayer, R.L., *See* Cooley, J.N., 14:30625
Mayers, J., Anisotropy and energy dependence of the differential neutron scattering cross-section in vanadium, 14:32753 (R;GB)
Mazaheri, G., *See* Mir, R., 14:31852
Mazer, J.J., *See* Bates, J.K., 14:30611
Maznyj, I.A., *See* Kumshaev, S.B., 14:31820
Mazumdar, M., *See* Easterling, R.G., 14:33009
Mazzilli, B.P., *See* Hiromoto, G., 14:30624
Mazzucato, E., Propagation of a Gaussian beam in a nonhomogeneous plasma, 14:32885 (R;US)
McArthur, D.A., Fission reactor pumped lasers: History and prospects, 14:31632 (R;US)
McBreen, J., Flow batteries, 14:30967 (BA;US)
McBride, A.F., Compendium of technical computer codes used in support of the DOE Office of Civilian Radioactive Waste Management, 14:30571 (R;US)
McCabe, D.E., *See* Nanstad, R.K., 14:31183
McCaffrey, R.R., Gas separation properties of phosphazene polymer membranes, 14:31433 (J;US)
McCann, W.J., Solid-state nuclear detectors for monitoring low levels of tritium, 14:32956 (J;US)
McCarn, L.B., *See* McBride, A.F., 14:30571
McCarron, E. M., *See* Chakraborty, A., 14:31309
McCarthy, J., QLISP for parallel processors. Final report, 15 July 1986-31 July 1988, 14:32974 (R;US)
McCarthy, J. F., Preconditioning the Kogut-Susskind fermion matrix, 14:32642 (J;US)
McCarthy, J.F., Biological (molecular and cellular) markers of toxicity: Semi-annual technical progress report (No.1), October 1, 1988–March 31, 1989, 14:32399 (R;US)
McCarty, J.G., *See* Krishnan, G.N., 14:30249
McCarty, K. F., *See* Radousky, H. B., 14:31312
McClain, W.H., *See* Lawrence, N., 14:32099
McClelland, J.F., *See* Jones, R.W., 14:31407
McClure, J.D., An analysis of severe air transport accidents, 14:30597 (R;US)
An analysis of the background and development of regulations for the air transport of plutonium in the USA, 14:30596 (R;US)
See Finley, N.C., 14:30451, 14:30594
McComick, D., *See* Rolfe, J., 14:31779
McConnell, J.W., *See* Olsen, D.K., 14:31786
McConnell, J.W. Jr., Testing waste forms containing high radionuclide loadings, 14:30468 (RA;US)
McCown, A.W., B-state excimer production following rare-gas halide trimer absorption, 14:31646 (BA;US)
See Greene, D.P., 14:31642
McCracken, S.H., *See* Peterson, J.M., 14:32026
McCreary, T. W., A simple purge system for determination of sulfur using the direct-current plasma, 14:31402 (J;US)
McCulloch, C., *See* Glasser, F.P., 14:30553
McCully, M.A., Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
McDaniel, C.W., *See* Izatt, R.M., 14:31439
McDonald, J.F., *See* Lambert, M.E., 14:32077
McDowell, W.J., Crown ethers as solvent extraction reagents: where do we stand?, 14:31413 (J;US)
See Alexandratos, S.P., 14:31445
See Chadwick, R.B., 14:31416
See Moyer, B.A., 14:31417
McElroy, P.A., *See* Zielinska, B., 14:31979
McElroy, R., Combustion enhancement by induced Rayleigh instability, 14:31681 (R;CA)
McEntire, B.J., Characterization of processing flaws in beta alumina, 14:31291 (BA;US)
McFadden, E.J. Jr., Technical development of HEPVM software, Paris, Lyon, France. April 17-26, 1989: Foreign trip report, 14:32996 (R;US)
McFarlane, A., *See* Walz, D.R., 14:31780, 14:31781
McGaughey, P.L., *See* Byrd, R.C., 14:31824
McGee, D.R., *See* Filipy, R.E., 14:32376
McGhee, W.D., Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)
McGill, T. C., *See* Johnson, M. B., 14:31357
McGinnes, D.F., *See* Dyer, A., 14:30533
McGlynn, S.P., *See* Klasinc, L., 14:31397
McGraw, A.C., *See* Sullivan, B.J., 14:30321
McGuire, J. H., Recoil distributions in particle transfer, 14:32518 (J;US)
McGuire, K., *See* Arunasalam, V., 14:32881
McHargue, C. J., *See* Krishnaswamy, J., 14:31359
McHargue, C.J., *See* O'Hern, M.E., 14:31317
McHenry, M. E., *See* Foldeaki, M., 14:31306
McIlveen, W.D., Effects of acidic precipitation and related pollutants in the terrestrial environment. A program description, 14:31997 (R;CA)
McInnes, P., The Minister's Task Force on Litter Abatement. Report, 14:31148 (R;CA)
McIntosh, L., *See* Debus, R.J., 14:32196
McIntyre, T., *See* Campbell, R.D., 14:30902
McKamey, C.G., Effect of chromium on room temperature ductility and fracture mode in Fe/sub 3/Al, 14:31245 (J;US)
McKeehan, E.R., Mobile supercompaction service for DAW, 14:30478 (RA;US)
McKenzie, B.B., *See* Zutavern, F.J., 14:31672
McKinley, R.S., *See* Patrick, P.H., 14:30699
McKone, T.E., Assessing tap-water contributions to inhalation exposure for volatile organic chemicals, 14:31094 (R;US)
McLachlan, A.D., Gene duplication and the origin of repetitive protein structures, 14:32119 (BA;US)
McLaughlin, J. B., Aerosol particle deposition in numerically simulated channel flow, 14:32532 (J;US)
McLean, A. B., Electronic and structural properties of a discommensurate monolayer system: GaAs(110)-(1×1)Bi, 14:31377 (J;US)
McMullin, P.G., *See* Dutta, S., 14:31340
McWilliams, B.M., Laser processing, 14:31345 (BA;US)
Meassick, S., *See* Stallard, B.W., 14:32886

Meckbach, R., Gamma shielding by buildings, 14:31600 (RA;AT;In German)
Medina, W.J., *See* Johnson, K.A., 14:31297
Medley, L.G., *See* Rennich, M.J., 14:30525
Medley, L.G. Sr., Systems approach to project management, 14:32965 (R;US)
Meffert, B., *See* Michalik, M., 14:32238
Mehta, D., *See* Singh, S., 14:32494
Meirovitch, H., *FTHETA* point exponents of polymers in $d=2$, 14:31362 (J;US)
Meisel, G., *See* Doll, P., 14:32648
Meixner, C., *See* Weise, L., 14:30845
Mel'nichenko, Yu.B., *See* Ivanitskij, P.G., 14:32800
Mel'nikov, P.I., *See* Knyazev, B.A., 14:32921
Melcher, J., *See* Rotte, K.H., 14:32319
Mele, E. J., *See* Lui, S., 14:31262
Melendres, C.A., Study of nanophase TiO_2 grain boundaries by Raman spectroscopy, 14:31271 (R;US)
Mellinger, G.B., *See* Piepel, G.F., 14:31348
Menanteau, B.P., Angiography of hemodialysis access devices with low osmolality contrast media, technique and results, 14:32277 (RA;DD)
Menas, F., Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)
Mendel, J.E., Solubility interpretation of leach tests, 14:30512 (RA;US)
Mendes, C.M., Comparative study of chemical cold agglomeration between two Brazilian phosphate fines: Patos de Minas and Catalao-Go, Brazil, 14:31389 (R;BR;In Portuguese)
Menegazzo, B.A., Dielectric and piezoelectric properties of PZT sintered in low temperatures, 14:31280 (R;BR;In Portuguese)
Meng, W.J., Amorphization of Zr_3Al by hydrogenation and subsequent electron irradiation, 14:31185 (R;US)
Menicucci, D., A preliminary assessment of the effect of sunshape on the performance of central receiver systems, 14:30751 (R;US)
Menjoz, A., Project of thermal storage in deep aquifer (Sarcelles, France). Simulation of the hydraulic and thermal behaviour of the system, 14:30958 (RA;CA;In English and French)
See Boisdet, A., 14:30940
Menke, B.H., *See* Nanstad, R.K., 14:31183
Mennerdahl, D., *See* Glass, R.E., 14:31611
Menon, V.B., Review of the factors affecting the stability of solids-stabilized emulsions, 14:31494 (J;US)
Menzel, H.G., Radiation protection dosimetry of neutrons and photons at a high energy accelerator using a low pressure proportional counter, 14:31842 (RA;AT)
Merboldt, K.D., *See* Bruhn, H., 14:32264
Mercer-Smith, J.A., *See* Cole, D.A., 14:32349
Mercier, C., Study of magnetic field lines after perturbation of a toroidal field with magnetic surfaces, 14:32869 (R;FR;In French)
Meredith, B.E., Remote handling and size reduction of solid alpha-active waste, 14:30494 (RA;US)
Merelli, A., Review of the nuclear safety activities in Italy, 14:30901 (R;IT;In Italian)
Mergan, L., *See* Van de Voorde, N., 14:30493
Merkle, K., *See* Hentschel, M., 14:32261
Merkle, K.L., High-resolution electron microscopy of metal/ceramic interfaces, 14:31186 (R;US)
Merrell, G.B., *See* Rogers, V.C., 14:31062
Merrill, J.T., *See* Wilson, S.W., 14:31624
Mertens, F. G., *See* Gouv@/re@, 14:32811
Mestayer, M. D., *See* Bortoletto, D., 14:32573
Mettlach, T.R., Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)
Metzger, A.E., *See* Arnold, J.R., 14:32458
Metzger, H., *See* Hoen, J., 14:32341
Meunier, P.H., *See* Bellet, M., 14:32215
Meyer, D., *See* Akerlof, C., 14:32462
Meyer, J.M., Adhesion between polyurethane insulation and media tubes, 14:31144 (R;DK;In Danish)
See Amby, L., 14:31146
Meyer, R., *See* Sandring, K.H., 14:32278
Meyer, R.A., *See* Roy, N., 14:32682
Meyer, W. T., A simple microprocessor for FASTBUS slave modules, 14:33014 (J;US)
Meyerstein, D., *See* Masarwa, M., 14:31501
Meyne, J., *See* Moyzis, R.K., 14:32176
Mezey, P.G., *See* Arteca, G.A., 14:32180
Michaels, E.D., *See* Park, W.K., 14:31491
Michalik, M., Grading of brain tumors by computer-aided analysis of CT images and by anamnestic data, 14:32238 (RA;DD;In German)
See Lehmann, R., 14:32299
See Planitzer, J., 14:32338
See Planitzer, M., 14:32303
See Reichmuth, B., 14:32334
Michalik, S., *See* Michalik, M., 14:32238
Michalske, T.A., Fractographic determination of crack-tip stress intensity, 14:31290 (BA;US)
Michel, E., *See* Dorner, H., 14:30905
Michel, F., Long-range intron-exon and intron-intron pairings involved in self-splicing of class II catalytic introns, 14:32206 (BA;US)
Michelotti, L., Orbital dynamics in the Tevatron double helix, 14:31714 (R;US)
Micko, A., Base irradiation history report of ASEA-ATOM fuel rods for the Super-Ramp Extension Project, 14:30827 (R;SE)
Fabrication and characterization of ASEA-ATOM fuel rods for the Super-Ramp Extension Project: The Super-Ramp Extension Project, 14:30826 (R;SE)
Midlock, J.L., *See* Engert, D.E., 14:32986
Migliori, S., Liquid nitrogen cooling system for FTU Tokamak machine, 14:32906 (RA;IT)
See Pizzuto, A., 14:32911
Miguel, A.H., *See* Tanner, R.L., 14:31978
Mikhajlov, V.F., On interpretation of the magnetic charge effect on ferromagnetic aerosols, 14:32585 (R;SU)
Mikkelsen, C., *See* Carlsen, H., 14:30872
Mikkelsen, T., Project WIND, phase IV, dispersion study. Aerial smoke plume observations and surface layer turbulence measurements. Part 1, 14:31909 (R;DK)
Miknis, F.P., *See* Wu, R., 14:30389
Milburn, J., *See* Keller, R., 14:31761
Miles, E.W., *See* Stackhouse, T., 14:32131
Miller, A., Radionuclide correlations in low level waste, 14:30545 (RA;US)
Miller, C., *See* Joy, D.S., 14:30523
Miller, C. A., *See* Lee, S. B., 14:32857
Miller, D.G., *See* Rard, J.A., 14:31532
Miller, E.K., *See* Burke, G.J., 14:31878
Miller, G., Ventilation survey manual: Revision 1, 14:31093 (R;US)
Miller, J.F., Evaluation of advanced lead-acid batteries developed for load-leveling applications, 14:30966 (BA;US)
See Marr, W.W., 14:30964
See Patil, P.G., 14:30965
Miller, J.H., *See* Forrest, S., 14:33001
See Morgan, T.L., 14:32393
Miller, L.A., *See* Su, Y.O., 14:31498
Miller, L.L., *See* Kenny, P.W., 14:31509
Miller, L.M., *See* Faler, M.P., 14:30694
Miller, R. C., *See* Auer, I. P., 14:32575
Miller, R.H., *See* Koontz, R.F., 14:31774
See Lavine, T.L., 14:31768
Miller, S.L., Which organic compounds could have occurred on the prebiotic earth?, 14:32080 (BA;US)
Miller, W. H., *See* Zhang, J. Z. H., 14:31550
Miller, W.H., Effect of fluctuations in state-specific unimolecular rate constants on the pressure dependence of the average unimolecular reaction rate, 14:31500 (J;US)
Millett, M., *See* Kasameyer, P., 14:32842
Millhone, J., What do we really mean by least-cost utility planning?, 14:31014 (RA;US)
Mills, D.R., *See* Priano, C., 14:32108
Mills, W.B., *See* Gherini, S.A., 14:32035
Milner, W.T., *See* Olsen, D.K., 14:31786
Milojkovic, D., *See* Vitorovic, D., 14:30376
Milora, S.L., *See* Fisher, P.W., 14:32948
Milosevic, M., *See* Nikolic, D., 14:32751

Milov, P.A., PIPE-LINE feature implementation on RSx11M operating system, 14:32997 (R;SU;In Russian)
Milton, K. A., *See* Bender, C. M., 14:32848
Min, B. I., *See* Garner, J., 14:32813
Minach, L., Cesium- and iodine contamination of food in South Tyrol, Italy, 14:32362 (RA;AT;In German)
Radiation burden of soil and vegetation in South Tyrol, Italy, after the Chernobyl accident, 14:32020 (RA;AT;In German)
Mini, R., Calibration of thermoluminescence dosemeters for personnel dosimetry, 14:31836 (RA;AT;In German)
Long-term sensitivity with an automatic TL personnel dosimetry system, 14:31837 (RA;AT;In German)
Minkoff, M., *See* Bayliss, A., 14:31273
Mioduszewski, P.K., *See* Langley, R.A., 14:32899
Mir, R., Study of straw chamber lifetime with argon ethane, 14:31852 (R;US)
Miranda, P.E.V. de., *See* Silva, T.C.V. da, 14:31202
Miranskij, V.A., Chiral symmetry breaking and nonperturbative scale anomaly in gauge field theories, 14:32617 (R;SU)
Mirza, C., Aquifer thermal energy storage experience with the Scarborough field trial, 14:30957 (RA;CA;In English and French)
See Lau, K.C., 14:30929
Mis, F.J., *See* Cline, J.E., 14:30462
Misfeldt, I., *See* Knudsen, P., 14:30871
Missenard, G., *See* Vanel, D., 14:32329
Mitchell, A., *See* Maiden, D., 14:31897
Mitchell, A. W., *See* Loong, C., 14:31302
Mitchell, J. W., *See* Seem, J. E., 14:31095
Mitlitsky, F., *See* McWilliams, B.M., 14:31345
Mitrjushkin, V.K., *See* Ambjoern, J., 14:32635
Mitsuyasu, K., *See* Miyata, T., 14:32164
Mitzi, D. B., *See* Urbach, J. S., 14:31313
Miyao, H., *See* Yamanouchi, T., 14:30482
Miyata, T., Male-driven molecular evolution: a model and nucleotide sequence analysis, 14:32164 (BA;US)
Mizrahi, S.S., *See* Aladim, S.R., 14:32823
Mo, J.N., *See* Fifield, L.K., 14:32662
Moazed, D., *See* Holler, H.F., 14:32149
Mock, R., *See* Sanford, T. W. L., 14:32888
Moffitt, W.C., *See* Wheeler, B.R., 14:30505
Mohagheghi, A., Enzyme production on cellulose/xylose mixture, 14:30723 (RA;US)
See Shiang, M., 14:30725
See Spindler, D.D., 14:30667
See Tucker, M.P., 14:30721
Mohagheghi, A. H., *See* Tang, C. Y., 14:32525
Mohan, K., Studies on a membrane reactor, 14:31490 (J;US)
Mohanty, K. M., *See* Axe, J. D., 14:31303
Mohn, R.K., *See* Feng, X., 14:30522
Mohr, R.K., *See* Finger, S.M., 14:30506
See Macedo, P.B., 14:30510
Molecke, M.A., *See* Arguello, J.G., 14:30584
Molnar, F., *See* Viragh, E., 14:30883
Molsen, H.P., CT-aided punctures in cerebral and spinal cystic processes, 14:32241 (RA;DD;In German)
Moneti, G. C., *See* Bortoletto, D., 14:32573
Montaser, A., *See* Chan, S., 14:32889
Monteiro, S.N., Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
Montenecourt, B.S., *See* Tsao, Y.M., 14:30726
Montenegro, N.P., Theoretical study of resonant tunneling in a double barrier structures, 14:32788 (RA;BR)
Montes, A., *See* Ferreira, J.L., 14:32781
Montrose, C.J., *See* Feng, X., 14:30522
See Finger, S.M., 14:30506
See Macedo, P.B., 14:30510
Moodenbaugh, A. R., *See* Axe, J. D., 14:31303
Moody, D.C., Proceedings of the DOE workshop on the role of a high-current accelerator in the future of nuclear medicine, 14:32348 (R;US)
Moody, K. J., Heavy-fragment radioactivity of ^{234}U, 14:32693 (J;US)
Mooney, J.L., *See* Rabideau, P.W., 14:31484
Moore, C.D., *See* Chao, Y., 14:31715
Moore, C.E., *See* Eaton, W.C., 14:31950
Moore, L.M., Standardized piezoelectric polymer (PVDF) gauge for detonator response measurement, 14:31892 (R;US)
Moore, M.R., Ethanol from cellulosic residues and crops, 14:30660 (RA;US)
Moore, P.B., Modus operandi of the ribosome, 14:32151 (BA;US)
Moore, R.E., *See* Hulsebos, J., 14:30360
Moos, D., *See* Zoback, M.D., 14:32429
Moosberg, D.G., *See* Seibert, A.F., 14:31453
Moosemiller, M.D., *See* Gieselmann, M.J., 14:31432
Moraes, R.V. de, Rotational motion of an artificial satellite perturbed by solar radiation pressure, 14:31860 (RA;BR)
Morais, P.C., Optical investigation of atomic steps in ultra-thin InGaAs/InP quantum wells grown by vapor levitation epitaxy, 14:31230 (R;BR)
See Cox, H.M., 14:31231
Morales, G. J., *See* Hinkel-Lipsker, D. E., 14:32537
Moran, T.F., *See* Thomas, E.W., 14:32491
Moras, D., *See* Dock-Bregeon, A.C., 14:32091
Moreau, C., Interaction of plasma-sprayed YBa/sub y/Cu/sub 3/0/sub x/ coatings with alumina substrates, 14:31284 (R;CA)
Moreau, J.F., Nephrotoxicity of high doses of contrast media in humans, 14:32274 (RA;DD)
Moreira, S.R.D., *See* Hiromoto, G., 14:30624
Moreno, J. C., Measurements of gain and line broadening in lithium-like aluminum, 14:32895 (J;US)
Moreno, J.E., *See* Torres V, G., 14:31281
Morera, J.P., *See* Ghendrih, P., 14:32860
See Grosman, A., 14:32861
Moretto, L.B., The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission, 14:32670 (R;US)
Morgan, E., *See* Jacob, N.P., 14:30457
Morgan, F.G., *See* Wieneke, R.E., 14:32935
Morgan, H.S., Computed and measured responses of a thick-walled hollow cylinder of salt subjected to both homogeneous and inhomogeneous loading, 14:30585 (R;US)
Morgan, P.E.D., Studies of synthesis, crystallography and sintering of β-aluminas: Final report, April 15, 1976–April 15, 1977, 14:31279 (R;US)
Morgan, R., *See* Xia, Y., 14:32200
Morgan, T.L., Molecular characterization of x-ray induced mutations at the HGPRT locus in plateau phase Chinese hamster ovary cells: Effect of dose, dose fractionation, and delayed plating, 14:32393 (R;US)
Morhenne, J., Optimization of the tobacco-drying process with respect to possible applications of solar radiation, 14:30754 (R;DE;In German)
Mori, W. B., *See* Wilks, S. C., 14:31710
Morimoto, Hiromi, *See* Williams, P., 14:32210
Morioka, M., *See* Asano, H., 14:30517
Morishima, H. and others, *See* Nishiwaki, Y., 14:30992
Morissette, R., *See* Nelson, T., 14:30610
Morita, M., Solid-state voltammetry in a three electrode electrochemical cell-on-a-chip with a microlithographically defined microelectrode, 14:31553 (J;US)
Moriwaki, Y., *See* Campbell, R.D., 14:30902
Morkoc, H., *See* Huang, D., 14:31352
Moroder, E., *See* Minach, L., 14:32362
Morofsky, E.L., *See* Arthurs, D.M., 14:30942
See Mirza, C., 14:30957
Moroney, S., *See* Benner, S.A., 14:32084
Morosin, B., Influence of electrolyte density on response of LiCl, 14:30968 (BA;US)
Moross, J., *See* Dunham, M. E., 14:31884
Moroz, A., *See* Roginski, R.T., 14:31504
Morozov, A.G., *See* Afanasiev, V.L., 14:32455
Morris, C. L., *See* Leitch, M. J., 14:32657
Morris, C.J., *See* Coburn, T.T., 14:30343
Morris, D. E., *See* Urbach, J. S., 14:31313
Morris, J.B., Electrode corrosion and ruthenium behavior in a small joule ceramic melter, 14:30519 (RA;US)
Morris, M.I., *See* Collins, E.D., 14:30459
Morris, P., *See* Borison, A., 14:31024
Morris, S.T., *See* Kingdon, R.D., 14:31861

Morris, T.W., *See* Saulys, A.C., 14:31804
Morrison, H.D., *See* Woodall, K.B., 14:30439
Morse, W. M., Review of RHIC as a B factory, 14:31709 (J;US)
Morse, W.M., Search for violation of time reversal invariance in $K_{\mu 3}$ decays, 14:32545 (R;US)
Morsi, B.I., *See* Chiang, Shiao-Hung, 14:30273
Morstin, K., *See* Schmitz, T., 14:31845
Morton, P.L., *See* Lavine, T.L., 14:31768
Moschopedis, S.E., Batch autoclave tests for the liquefaction of Alberta subbituminous coals: I.G. Farben liquefaction process, 14:30241 (R;CA)
Moselle, J., *See* Holden, M.S., 14:31652
Mosko, S.W., *See* Olsen, D.K., 14:31786
Moss, M., *See* Roth, E.P., 14:32929
Moss, M.L., *See* Frey, P.A., 14:32135
Moss, S. C., *See* Kan, X. B., 14:31363
Mosseri, S., *See* Nahor, G.S., 14:31558
Mostovoy, S., *See* Wu, W., 14:31269
Mote, J.D., Characterization and fundamental studies on CuO sorbent materials to determine attrition mechanisms on substrate gamma alumina: Technical progress report No. 9, September 23, 1988–December 23, 1988, 14:30804 (R;US)
Motisuke, P., *See* Iikawa, F., 14:31207
Mouchet, M., *See* Bonnet-Bidaud, J.M., 14:32448
Moudden, A. H., *See* Axe, J. D., 14:31303
Mouli, N., *See* Jones, G. II, 14:31566
Moura Neto, C., Uranium alloys for using in fast breeder reactors, 14:31189 (R;BR;In Portuguese)
Mouring, R.W., *See* Peishel, F.L., 14:31590
Mours, B., Capacitive device approach to gravitational wave detection, 14:32834 (R;FR)
Moward, R., *See* Feng, X., 14:30522
Mowbray, S.L., *See* Thorsness, P.E., 14:32141
Moxhay, P., Coupled-channel effects in the decay $\Upsilon(3S) \rightarrow \Upsilon(1S)\pi^+\pi^-$, 14:32615 (J;US)
Moya, J.L., The use of a thermal probe to determine the effective thermal conductivity of packaging contents, 14:30587 (R;US)
Thermal analyses of a generic rail cask model and thermal response of a test article using different high temperature boundary conditions, 14:30598 (R;US)
See Allen, G.C., 14:30600
See Keltner, N.R., 14:30601
Moyer, B.A., Selective extraction of Cu^{2+} and Ag^{+} ions from sulfuric acid by synergistic combinations of tetradentate thia macrocycles with didodecylnaphthalene sulfonic acid, 14:31417 (J;US)
Moyzis, R.K., Process of labeling specific chromosomes using recombinant repetitive DNA, 14:32176 (P;US)
Mrigank, *See* Kothekar, V., 14:32190
Mshaiel, N., *See* Dev, H., 14:31998
Mueck, K., Measurements of the Research Centre Seibersdorf with regard to the reactor accident at Chernobyl, 14:32015 (RA;AT)
Reducing radiation doses at a 10MW research reactor, 14:30892 (RA;AT)
Muehler, A., *See* Luening, M., 14:32222
Muehlsteffen, A., *See* Baierl, P., 14:32239
Mueller, C., *See* Sandring, K.H., 14:32281
Mueller, H., *See* Rabitsch, H., 14:32014
Mueller, K.D., *See* Schmitz, T., 14:31845
Mugge, M., *See* Kasameyer, P., 14:32842
Muggleton, A.H.F., Deposition techniques for the preparation of thin film nuclear targets, 14:31178 (R;AU)
Mui, D., *See* Huang, D., 14:31352
Mukashev, B.N., *See* Tokmoldin, S.Zh., 14:32799
Mukherjee, P., Optical technique for broadband microwave absorption spectroscopy in aqueous media, 14:31637 (BA;US)
Mukhopadhyay, N. C., *See* Benmerrouche, M., 14:32603
Mulac, W.A., *See* Liu, A., 14:31528
Mulcahey, T.P., *See* Miller, J.F., 14:30966
Mullen, R.A., High-brightness diode lasers for blue-green applications. Interim technical report, 1 July 1987-31 December 1988, 14:31627 (R;US)
Mullenders, L.H.F., *See* Buul, P.P.W. van, 14:32373
Muller, R.N., Nuclear magnetic relaxometry: a technique complementary to imaging and spectroscopy, 14:32263 (RA;DD)
See Rinck, P., 14:32229
Mullins, J.C., *See* McCully, M.A., 14:31454
Munakata, K., *See* Kohno, T., 14:32475
Mundt, R., *See* Borchardt, D., 14:30893
Muniz, R.B., *See* Oliveira, L.E., 14:32794
Munson, D.E., Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 14:30582 (R;US)
Munson, R.K., *See* Gherini, S.A., 14:32035
Munter, P., *See* Martens, P., 14:30750
Muradian, A., *See* Stephenson, L.C., 14:30363
Murakami, H., *See* Kohno, T., 14:32475
See Nagata, K., 14:32473
See Nakamura, Y., 14:32474
Murakami, M., *See* Arunasalam, V., 14:32881
Murakoshi, T., *See* Asano, H., 14:30517
Muralidhara, H.S., Electro-acoustic dewatering (EAD) a novel approach for food processing, and recovery, 14:31455 (J;US)
Muralikrishna, P., Rocket-borne Langmuir probe response to an applied periodic potential, 14:31799 (RA;BR)
Muravitskij, A.V., *See* Vertebnyj, V.P., 14:32691
Murdoch, R.W., *See* Eaton, W.C., 14:31950
Murphy, C.E., *See* Jalbert, R.A., 14:32960
Murphy, C.E. Jr., *See* Kurzeja, R.J., 14:32957
Murphy, M., Training manual for methanol-fuel use in transit operations, 14:31097 (R;US)
Murphy, M.J., *See* Krenelka, T.C., 14:31163
Murphy, V.G., *See* Elander, R.T., 14:30713
Murrary, M., The effects of snow on landmarks in K_u band SAR [Synthetic Aperture Radar] images, 14:31866 (R;US)
Murray, R.W., *See* Morita, M., 14:31553
Murty, G.S., *See* Basu, T.K., 14:32418
Murzin, A.V., *See* Vertebnyj, V.P., 14:32691
Musikas, C., Potentiality of nonorganophosphorus extractants in chemical separations of actinides, 14:30443 (J;US)
Muto, A., *See* Jukes, T.H., 14:32156
See Osawa, S., 14:32157
Myer, L.R., *See* Zheng, Z., 14:32432
Myers, D.R., *See* Emery, K.A., 14:30738
Myhrer, F., *See* Umino, Y., 14:32612
Mynick, H.E., The gBL transport equations, 14:32883 (R;US)
Myznikov, K.P., Status and development of Serpukhov tevatron, 14:31787 (R;SU;In Russian)

N

Nabielek, H., *See* Schenk, W., 14:30906
Naccache, D., *See* Bourgade, J.L., 14:31179
Nagata, K., Observation of high energy electrons and protons in the South Atlantic geomagnetic anomaly by Ohzora Satellite, 14:32473 (RA;BR)
See Nakamura, Y., 14:32474
Nagel, P., *See* Glass, R.E., 14:31611
Nagy, G., Measurements and calculations on the responses of a NaI(Tl) detector immersed in a water tank containing different radioisotopes, 14:31832 (RA;AT)
Sensitivity measurements of an environmental GM-monitor for Ra-226 series placed on the ground surface, 14:31830 (RA;AT)
See Koblinger, L., 14:32767
Nahor, G.S., Polyelectrolyte-stabilized metal oxide hydrosols as catalysts for the photooxidation of water by zinc porphyrins, 14:31558 (J;US)
Nahory, R.E., *See* Morais, P.C., 14:31230
Nair, R.P.K., Activities planning of Nuclear Data Center - 1980, 14:32645 (R;BR;In Portuguese)
See Pinheiro, A.M.B.S., 14:32991
Naito, T., *See* Sherman, R.H., 14:32963
Najbar, J., Infrared study of carbon on alumina, 14:31182 (R;US)
Nakagawa, A., *See* Beale, J.M., 14:31507
Nakahigashi, K., *See* Ozeki, H., 14:32158
Nakamoto, A., *See* Kohno, T., 14:32475
See Nagata, K., 14:32473

Nakamura, K., Quantum dynamics of a pulsed spin system: Long-time behavior of semiclassical wave functions, 14:32858 (J;US)
Nakamura, Y., High energy electron and proton observations in the South Atlantic geomagnetic anomaly, 14:32474 (RA;BR)
Nan, G., *See* Cao, Z., 14:30382
Nanstad, R.K., Effects of irradiation on K_{Ic} curves for high-copper welds, 14:31183 (R;US)
Napp, E., Case-Hoyt/Rochester Corporation printing waste heat recovery project. Final report, 14:31125 (R;US)
Nappa, L., Liquid fuel from oil shales by hydrogenation and aqueous conversion, 14:30340 (RA;CN)
Napper, A.D., *See* Tramontano, A., 14:32088
Narayan, J., *See* Krishnaswamy, J., 14:31359
Narayanan, R., *See* Kiskis, J., 14:32641
Narayanasamy, A., *See* Melendres, C.A., 14:31271
Naruse, Y., *See* Sherman, R.H., 14:32963
Nascimento, I.C. do, *See* Vannucci, A., 14:32872
Nash, J., *See* Boyarski, A., 14:31854
See Kent, J., 14:31778
See Levi, M., 14:31777
Nash, K.L., Hydrolytic and radiolytic degradation of OϕD (iB)CMPO; continuing studies, 14:31571 (J;US)
Nash, R.A., *See* Davis, D.S., 14:31945
Nasreen, G., *See* Manson, S.T., 14:32486
Natarajan, A.T., *See* Buul, P.P.W. van, 14:32373
Naudet, C., Threshold behavior of electron pair production in *p*-Be collisions, 14:32659 (J;US)
Nauert, T., *See* Roemer, T., 14:32252
Naumann, R. A., *See* Mann, L. G., 14:32676
Nawwar, A.M., Design and construction of automated freeze-thaw testing equipment for concrete. Final report, 14:31663 (R;CA)
Nayak, S.K., Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid, 14:30447 (J;US)
Nazar, L., *See* Cox, H.M., 14:31231
Nazarova, O.A., *See* Tokmoldin, S.Zh., 14:32799
Nazinin, *See* Yefimov, V.M., 14:30356
Nebesny, K.W., Quantitation of Auger and X-ray photoelectron spectroscopies, 14:31464 (J;US)
Neeper, D.A., Potential benefits of distributed PCM thermal, 14:31068 (R;US)
Neerinck, D., *See* Locquet, J., 14:31263
Nehls, J.W. Jr., *See* Joy, D.S., 14:30523
Neilson, R.M. Jr., *See* McConnell, J.W. Jr., 14:30468
Nell, M., Calculation of requirements respectively of radiation protection as condition for the permission of medical X-ray plants, 14:30649 (RA;AT)
Nellen, L., *See* Chan Hongmo, 14:32592
Nelson, D.H., *See* Keller, R., 14:31761
Nelson, J.L., *See* Gennaro, M.S., 14:30821
Nelson, N.A., *See* Haxo, H.E. Jr., 14:31112
Nelson, R., *See* Nawwar, A.M., 14:31663
See Rolfe, J., 14:31779
Nelson, T., Yucca Mountain Project waste package design for MRS [Monitored Retrievable Storage] system studies, 14:30610 (R;US)
Nemeth, I., *See* Andrasi, A., 14:32016
Neogi, P., *See* Friberg, S.E., 14:30290
Neri, J.A.C.F., *See* Jayanthi, U.B., 14:31798
See Villela, T., 14:31797
Neta, P., *See* Nahor, G.S., 14:31558
Neta, R., *See* Oppenheim, J.J., 14:32364
Neuburger, E., *See* Bartels, R., 14:30915
Neuffer, D., A general formalism for quasi-local correction of multipole distortions in periodic transport systems, 14:31759 (R;US)
Neuman, E., Influence of cooling water outlet of the Ringhals power plant on the coastal fish colony, 14:30886 (R;SE;In Swedish)
See Grimaas, U., 14:30887
Neuschaefer, G.H., *See* Wangler, T.P., 14:31720
Newberry, B. P., A paraxial theory for the propagation of ultrasonic beams in anisotropic solids, 14:31667 (J;US)
Newton, J.O., Recent developments in heavy-ion induced fission, 14:32694 (R;AU)
See Leigh, J.R., 14:32674
Newton, M.A., *See* Prono, D.S., 14:31707
Nexsen, W., *See* Prono, D.S., 14:31707
Nezlin, M.V., *See* Afanasiev, V.L., 14:32455
Ng, C.K., Incorporating functional requirements into the structural design of the DWPF, 14:30492 (RA;US)
Ng, J. N., *See* Liu, J., 14:32614
Ngcoya, J., *See* Freeman, M., 14:31105
Nguyen, A., *See* Steele, W.V., 14:30311
Nguyen, V.H., *See* Goyer, N., 14:31058
Ni Baoling, *See* Shen Minzi, 14:32056
Nichols, F.A., *See* Erck, R.A., 14:31187
Nickel, H., *See* Funke, T., 14:31214
Nicklin, M., *See* Paul, A.V., 14:32110
Nicklow, R. M., *See* Cable, J. W., 14:31253
Nicks, M., *See* Ensor, D.D., 14:31418
Nicol, J.M., Dynamics of molecular hydrogen adsorbed in CoNa-A zeolite, 14:31545 (J;US)
Niczyporuk, B.B., *See* Hanson, G.G., 14:31855
Nielebock, E., *See* Buhtz, C., 14:32296
Nielsen, H.B., Random dynamics and relations between the number of fermion generations and the fine structure, 14:32591 (R;DK)
Nielsen, M.G., Remote process cell mercury transfer pumps for DWPF, 14:30495 (RA;US)
Nielsen, P.R., Measuring ammonia content in flue gas, 14:30807 (R;DK;In Danish)
Nielson, K.K., *See* Rogers, V.C., 14:31062
Nielson, R., *See* Wherle, R., 14:31785
Nierhaus, K.H., New aspects of structure, assembly, evolution, and function of ribosomes, 14:32146 (BA;US)
Nigro, A.A., *See* Poe, T.P., 14:30684
Nihei, K., *See* Long, J.C.S., 14:32433
Nihlgaard, B., Forest liming in small catchment areas. Background information and preliminary results on liming effects 1983-1987, 14:32004 (R;SE)
Nikaido, Hiroshi, *See* Williams, P., 14:32210
Nikiforov, A.A., *See* Goncharov, V.N., 14:32998
Nikishin, B.K., *See* Isaenko, V.I., 14:32762
Nikitin, S.G., *See* Milov, P.A., 14:32997
Nikitin, V.V., Standardization of x-ray diagnostic irradiation on the basis of control level system, 14:32761 (RA;SU;In Russian)
Nikolic, D., Measurement of fast neutron spectra from iron shielded americium-beryllium source, 14:32751 (RA;AT)
Nikolic, S., *See* Randic, M., 14:32194
Nilsson, Aa., *See* Noemmik, H., 14:32003
Nilsson, G., Light reduction regarding to the greenhouse construction. Average transmission factor for direct light through the greenhouse roof, 14:30755 (R;SE;In Swedish)
See Svenson, O., 14:30605
Nimal, B., *See* Duchemin, B., 14:30856
Nimal, J.C., *See* Duchemin, B., 14:30856
See Vergnaud, T., 14:32982
Nimick, F.B., Relevance of partial saturation to the mechanical behavior of tuffs, 14:30581 (R;US)
Ninio, J., Kinetic devices in protein synthesis, DNA replication, and mismatch repair, 14:32143 (BA;US)
Ninkovic, M., *See* Antic, D., 14:30916
Nir, Y., Mass ratio m/sub c//m/sub b/ in semi-leptonic b-decays, 14:32593 (J;NL)
Nishikawa, M., Effect of pressure on the reaction of electrons with CO_2 in nonpolar solvents, 14:31572 (J;US)
Nishimura, H., *See* Forest, E., 14:31721
Nishimura, Hiroshi, *See* Kim, C.H., 14:31762
Nishino, H., Development of a multi-purpose incinerating melter, 14:30486 (RA;US)
Nishiwaki, Y., Bikini accident and Chernobyl accident, 14:32389 (RA;AT)
Possible application of fuzzy set theory to radiation protection and risk assessment, 14:33006 (RA;AT)
Uncertainties of risk assessment and public attitude study on nuclear energy based on fuzzy measure and fuzzy integral model, 14:30992 (RA;AT)
Nix, J.R., Our 50-year odyssey with fission: Summary, 14:32738 (R;US)
Nixon, S.C., *See* Cheng, H., 14:32066

Noble, R.D., CO_2 separation using facilitated transport ion exchange membranes, 14:31426 (J;US)
See Koval, C.A., 14:30268
Noda, K., *See* Slagle, O.D., 14:32927
Nodulman, L.J., *See* Dawson, J.W., 14:31800
Noemmik, H., Sulphate stores and sulphate adsorption capacity of the spodic B horizon of Swedish forest soils, 14:32003 (R;SE)
Noggle, T.S., *See* Appleton, B.R., 14:31346
Noguti, I., Potential of heavy minerals in the Valenca-Itacare, Bahia (Brazil) region - Sampling characterization and ore processing, 14:31388 (R;BR;In Portuguese)
Noiseux, D.U., Study of effective aeolian wind power imparted to single conductor spans, 14:30812 (R;CA)
Noiasco, I. and others, *See* Abecasis, M.M., 14:32217
Nolen, R.L., *See* James, B.J., 14:32939
Nolen, R.L. Jr., A new tritium facility - The Weapons Engineering Tritium Facility at Los Alamos National Laboratory, 14:32938 (J;US)
Noll, L.A., Surfactant loss: Effects of temperature, salinity, and wettability, 14:30292 (R;US)
Nollet, A.R., Evaluation of rotary-drum air classification of shredded and unshredded municipal solid waste. Final report, 14:31149 (R;US)
Nomura, M., Role of RNA and protein in ribosome function: a review of early reconstitution studies and prospects for future studies, 14:32145 (BA;US)
Nordaunet, L., New methods for the covering of the energy demand of agriculture. Mobile electric operation, 14:31131 (R;NO;In Norwegian)
Norford, L.K., The sum of megabytes equals gigawatts: Energy consumption and efficiency of office PC's and related equipment, 14:31038 (R;US)
Norman, J.K., *See* Cole, D.A., 14:32349
Norris, J.O.W., *See* Dalgarno, B.G., 14:31315
Norris, J.R., *See* Angerhofer, A., 14:31565
Northby, J. A., *See* Xie, J., 14:31485
Norton, A.P., Mechanistic aspects of the photooxidation of water at the n-TiO_2/aqueous interface: optically induced transients as a kinetic probe, 14:31564 (J;US)
Norton, N.P., The dynamic duo: New technology and willing staff, 14:32966 (R;US)
Nosaka, M., *See* Go, M., 14:32170
Notaro, F., Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report, 14:31164 (R;US)
Notter, M., Radioecologic control of the surroundings of the Ringhals nuclear power station up to and incl. 1986, 14:32779 (R;SE;In Swedish)
Novaco, A. D., Rotational states of H_2, HD, and D_2 on graphite, 14:31369 (J;US)
Novak, I., *See* Klasinc, L., 14:31397
Novakov, T., *See* Hansen, A.D.A., 14:31930, 14:31932
Novoselov, G.M., *See* Vertebnyj, V.P., 14:32691
Nowak, E.J., Issues pertinent to sealing of radioactive waste repositories in bedded salt formations, 14:30603 (R;US)
Nowotny, V., *See* Nierhaus, K.H., 14:32146
Nunes, O.A.C., *See* Rodrigues-Costa, C., 14:32804
Nunziato, J.W., *See* Baer, M.R., 14:31583
Nurzynski, J., *See* Hebbard, D.F., 14:32695
Nuttall, H.E., Design of a new oil shale retort for China's fushun region, 14:30353 (RA;CN)
Nygren, E., *See* Lu, G. Q., 14:31361

O

O'Brien, P.D., OGR [Office of Geologic Repositories] repository-specific rod consolidation study: Effect on costs, schedules, and operations at the Yucca Mountain repository, 14:30576 (R;US)
O'Connell, R., Northeast Regional Biomass Energy Program: Progress report, January 1989–March 1989, 14:30672 (R;US)
O'Connell, W.J., Waste package performance assessment for the Yucca Mountain Project, 14:30613 (R;US)
O'Connor, T.E., *See* Kamperschroer, J.H., 14:32928
O'Handley, R. C., *See* Foldeaki, M., 14:31306
O'Hern, M.E., Determination of the mechanical properties of diamond and diamond-like films by the ultra-low load indentation technique, 14:31317 (R;US)
O'Kula, K.R., Preliminary risks associated with postulated tritium release from production reactor operation, 14:32958 (J;US)
O'Malley, M.W., *See* Loubriel, G.M., 14:31673
O'Malley, W.M., *See* Zutavern, F.J., 14:31672
O'Rourke, P.J., *See* Amsden, A.A., 14:31161
O'Shaughnessy, K.F., *See* Boyarski, A., 14:31854
Oakes, M., Evolving ribosome structure and function: rRNA and the translation mechanism, 14:32147 (BA;US)
Oatman, E.N., Legacy of traditional planning, 14:31010 (RA;US)
Obelic, B., Monitoring of the /sup 14/C activity in the environment of the nuclear power plant Krsko in Yugoslavia, 14:30884 (RA;AT)
Obenschain, S., *See* Pronko, M., 14:32926
Obletter, N., *See* Breit, A., 14:32323
Oborny, M.C., *See* Blair, D.S., 14:31336
Obst, J., *See* Loeschhorn, U., 14:30897
Odian, A., *See* Mir, R., 14:31852
Oehrlein, M., *See* Batheja, P., 14:30825
Oertzen, W. von, Signatures of nucleon promotion in heavy ion reactions at barrier energies, 14:32709 (RA;DE)
Two-center effects in nucleon transfer between nuclei, 14:32708 (RA;DE)
Oesterreich, F.U., *See* Triebel, H.J., 14:32288
Oettle, E., Results of postoperative radiotherapy and radiation of recurrent tumours, observed in adenomas of the pituitary gland operated at a primary stage, 14:32344 (R;DE;In German)
Oeye, S., Project K 30 meter glass fiber wind turbine-blade. Technological description, 14:30786 (R;DK;In Danish)
Ofengenden, R.G., *See* Kumshaev, S.B., 14:31820
Oguada, R.A., *See* Rao, P.S., 14:30298
Oh, K.K., *See* Baker, J.O., 14:30716, 14:30717
See Grohmann, K., 14:30718
See Tatsumoto, K., 14:30715
Oh, M.S., Mechanism of low-temperature water evolution from Green River Formation oil shale, 14:30394 (R;US)
Study of gas evolution during oil shale pyrolysis by TQMS, 14:30346 (RA;CN)
Ohama, T., *See* Osawa, S., 14:32157
Ohlrogge, J.B., Role of acyl carrier protein isoforms in plant lipid metabolism: Progress report, 14:32173 (R;US)
Ohlrogge, K., *See* Koske, P.H., 14:31446
Ohlsson, T., Testing station at Soesdala. Experiments concerning energy forest on organogenic soil (exploited peatland), 14:30741 (R;SE;In Swedish)
Ohmoto, S., *See* Hayashi, M., 14:30364
Ohmstede, W.D., Applications of large-eddy simulation: Model comparison and calibration: Technical report B048682-1, 14:31911 (R;US)
Ohshima, K., *See* Kan, X. B., 14:31363
Ohyama, K., *See* Ozeki, H., 14:32158
Oijala, J.E., *See* Early, R.A., 14:31775
Okamoto, P.R., *See* Meng, W.J., 14:31185
Oki, T., *See* Yabushita, T., 14:30355
Okolowicz, J., Giant dipole resonances in hot nuclear matter in the model of self-relaxing mean-field, 14:32707 (R;DE)
Monopole and quadrupole vibrations of a hot nucleus, 14:32705 (R;DE)
Okubo, S., *See* Das, A., 14:32843
Okuda, H., *See* Matsubara, T., 14:30864
Olander, D.R., Molecular beam studies of silicon etching by F/sub 2/, 14:31347 (BA;US)
Olavson, L., *See* Lynch, F., 14:32410
Oldenborg, R. C., *See* Simons, J. W., 14:32515
Olesen, P.B., *See* Carlsen, H., 14:30872
Olesik, S.V., Characterization and optimization of flame photometric detection in supercritical fluid chromatography, 14:31399 (J;US)
Olins, A.L., *See* Cadilla, C.L. Harp, J., 14:32198
Olins, D.E., *See* Cadilla, C.L. Harp, J., 14:32198
Oliveira, C., *See* Salgado, J., 14:30647
Oliveira, I.C. de, *See* Vannucci, A., 14:32872
Oliveira, J.B.B., Preparation and characterization of ohmic contacts to n-GaAs and p-GaSb, 14:31208 (RA;BR)

Oliveira, J.C.M. de, Gamma ray attenuation as a method to determine the water infiltration and redistribution parameters in soil, 14:31814 (RA;BR)
Oliveira, L.E., Plasmon excitations in some II - VI and IV -VI semiconductors, 14:32794 (RA;BR)
Oliver, W.C., *See* O'Hern, M.E., 14:31317
Olivieri, C.A., *See* Oliveira, J.B.B., 14:31208
Olmstead, M. A., *See* Bringans, R. D., 14:31379
Olness, D., Sensors for in situ monitoring of elastic properties, 14:31622 (R;US)
Olnon, F.M., *See* Lindqvist, M., 14:32460
Olsen, C.R., *See* Ashwood, T.L., 14:32038
Olsen, D.K., HISTRAP [Heavy Ion Storage Ring for Atomic Physics] prototype hardware studies, 14:31786 (R;US)
See Noll, L.A., 14:30292
Olsen, G.J., Earliest phylogenetic branchings: comparing rRNA-based evolutionary trees inferred with various techniques, 14:32160 (BA;US)
See Pace, N.R., 14:32100
Olsen, H., *See* Sorensen, S.N., 14:30953
Olson, C.G., *See* Arko, A.J., 14:31393
Olson, J. M., *See* Patel, D., 14:31364
Olsson, O., Site characterization and validation. Borehole radar investigations, Stage 1, 14:30609 (R;SE)
Olsson, S.E., Medical consequences of a nuclear plant accident, 14:30925 (R;SE;In Swedish)
Oma, K.H., *See* Ross, W.A., 14:30473
Omberg, R.P., *See* Leggett, R.D., 14:30850
Omick, S.R., *See* Ranade, S.J., 14:30749
Omura, S., *See* Beale, J.M., 14:31507
Oneda, S., *See* Slaughter, M. D., 14:32601
Ongstad, A.P., Photochemistry of O_3/HNCO mixtures, 14:31562 (J;US)
Onozaki, K., *See* Oppenheim, J.J., 14:32364
Onuchic, J.N., Adiabaticity criteria for outer-sphere bimolecular electron-transfer reactions, 14:31510 (J;US)
Classical and quantum pictures of reaction dynamics in condensed matter: resonances, dephasing, and all that, 14:31535 (J;US)
Onuffer, J.J., *See* Stackhouse, T., 14:32131
Ophel, T.R., Identification and rejection of energy-degraded events in gas ionization counters, 14:31802 (R;AU)
See Hebbard, D.F., 14:32695
Oppenheim, J.J., Potential therapeutic applications for interleukin 1: anti-tumor and hematopoietic effects, 14:32364 (R;US)
Ordonez, S., Plastic behaviour of zircoloy-4 sheets in function of the temperature, 14:31210 (R;BR;In Spanish)
Oref, I., High temperature deviations from Rice–Ramsberger–Kassel–Marcus unimolecular rate coefficients expressions, 14:31480 (J;US)
Orgel, L.E., Evolution of the genetic apparatus: a review, 14:32079 (BA;US)
Oriani, R.A., *See* Gopaliengar, R., 14:31237
Orkild, P. P., *See* Byers, F. M., Jr., 14:32425
Orr, N.A., *See* Ophel, T.R., 14:31802
See Woods, C.L., 14:32488, 14:32661
Orsini, A., *See* Ferro, C., 14:32912
Osawa, S., Role directional mutation pressure in the evolution of the eubacterial genetic code, 14:32157 (BA;US)
See Jukes, T.H., 14:32156
Osborn, R., High energy magnetic inelastic neutron scattering at ISIS, 14:32752 (R;GB)
Oser, B., *See* Wieczorek, H., 14:30483
Osher, J.E., Capabilities and some applications of the LLNL 100-kV electric gun, 14:31623 (R;US)
Osseo-Asare, K., Enhanced solvent extraction with water-in-oil microemulsions, 14:31414 (J;US)
See Chaiko, D.J., 14:31419
See Xue, T., 14:31440
Osterwald, C.R., *See* Emery, K.A., 14:30738
Ostmeyer, R.O., *See* Finley, N.C., 14:30451
Ots, A., Utilization of Estonian oil shale at thermal power plants, 14:30409 (RA;CN)
Ott, E., *See* Finn, J. M., 14:32540
Ottinger, C.A., *See* Sanders, T.L., 14:30580
Otwinowski, Z., *See* Achari, A., 14:32122
Ouvry, J.F., Scale effect experiment in a fractured rock mass phase 2. Volume 5. Methodology and results of in-situ stress measurement carried out in the granitic rock mass at Fanay-Augeres, 14:30559 (R;FR;In French)
Ovenden, L., Holocene proxy-climate data from the Canadian Arctic, 14:32413 (R;CA)
Overbye, L.J., Identification of a non-specific inhibitor of [methyl^{3}H]thymidine incorporation into DNA of normal and preneoplastic cells, 14:32211 (R;US)
Ovrut, B. A., *See* Evans, M., 14:32624
Owenby, R.N., Fiber optic sensing in a high explosives environment, 14:31874 (R;US)
Owyoung, A., *See* Esherick, P., 14:31640
Ozeki, H., Genetic system of chloroplasts, 14:32158 (BA;US)

P

Paalsson, I., *See* Nihlgaard, B., 14:32004
Pabst, M., *See* Wangler, T.P., 14:31720
Pace, B., *See* Pace, N.R., 14:32100
Pace, N.R., Structure and catalytic function in ribonuclease P, 14:32100 (BA;US)
Pack, R., Expert training systems to enhance plant operations decision making: Final report, 14:30876 (R;US)
Padilla, A., *See* Harris, R.A., 14:30926
Paeivinen, R., *See* Kosola, J., 14:30813
Paige, E.L., *See* Morris, J.B., 14:30519
Pajot, J., Manufacture of the first fuel charge for the SUPER-PHENIX 1 reactor, 14:30847 (R;FR)
Paliwoda, E.A., *See* Olesik, S.V., 14:31399
Pallavicini, R., *See* Cappelli, A., 14:32449
Palmer, B. A., *See* Simons, J. W., 14:32515
Palmer, C.D., Design and implementation of a heated water injection experiment in an unconsolidated aquifer, 14:30956 (RA;CA;In English and French)
Palmer, D.A., Potentiometric determination of the molal formation constants of ferrous acetate complexes in aqueous solutions to high temperature, 14:31538 (J;US)
Palmer, D.E., *See* Parsley, M.J., 14:30693
See Poe, T.P., 14:30680
Palmer, J., *See* Cherdack, R.N., 14:32944
Palmer, R.B., *See* Deruyter, H., 14:31772
Palounek, A.P.T., *See* Hanson, G.G., 14:31855
Pan Shulan, Application of S. H. and O. stable isotopes to groundwater research in China, 14:32057 (RA;XA)
Pana, I., What are the limits of a CT examination in diagnosing adrenal tumours?, 14:32342 (RA;DD)
Panayotov, D., CO isotopic exchange reaction over Rh/Al_2O_3: nondissociative exchange on metallic Rh sites, 14:31529 (J;US)
Pandey, R., Excitonic states in pure and impurity-doped magnesium oxide, 14:31372 (J;US)
Pang, B.-Q., *See* Shen, G.-J., 14:30955
Pankuch, P., *See* Alexander, J.A., 14:31701
Pankuch, P.J., *See* Ramirez, J.J., 14:32930
Panov, I.V., *See* Lyutostanskij, Yu.S., 14:32457
Pantyushin, A.A., Gauge invariant gravitation theory. 1. Gravitational field source and spin, 14:32632 (R;SU;In Russian)
Papineau, M., Studies of the ionic balance of Laflamme Lake in 1985 and 1986, 14:32034 (R;CA;In French)
Paquin, P., *See* Bennett, P.C., 14:31610
Parent, F., *See* Ferreira, J.G., 14:32497
Parent, L., *See* Moreau, C., 14:31284
Paretzke, H.G., *See* Meckbach, R., 14:31600
Parise, J.A.R., *See* Souza Dutra, A. de, 14:31655
Park, I. H., Experimental evidence for the non-Abelian nature of QCD from a study of multijet events produced in e^+e^- annihilation, 14:32570 (J;US)
Park, J.F., *See* Filipy, R.E., 14:32376
Park, S.J., *See* Laskowski, M. Jr., 14:32132
Park, W.J., *See* Eichholz, G.G., 14:30618
Park, W.K., Separation of nitrogen isotopes by displacement band chromatography, 14:31491 (J;US)

Parkash, S., Round robin tests, 1982. Petrographic analysis for a high volatile Australian coal and its liquefied residue, 14:30269 (R;CA)
Parker, C.D., *See* Dod, R.L., 14:31933
Parker, G.E., Applying understanding of individual behavior and team dynamics within the value engineering process, 14:32968 (R;US)
Parker, J.C., Prediction ranges. Annual review, 14:30974 (R;CA)
See Tharp, W.H., 14:30973
Parker, R.C., Methods for detection of fused alumina powder, used as a tracer aerosol, on air sample filters, 14:31587 (R;GB)
Parks, C.V., *See* Brady, M.C., 14:30588
See Hermann, O.W., 14:30569
Parlog, M., Investigation of the reaction mechanisms in /sup 19/F - medium-light nuclei systems, 14:32718 (R;RO;In Romanian)
Parnell, T.A., *See* Takahashi, Y., 14:32680
Parrish, R.H., *See* O'Hern, M.E., 14:31317
Parsley, M.J., Variation in capture efficiency of a beach seine for small fishes, 14:30693 (RA;US)
Parsons, C.A., *See* Goncher, G.M., 14:31234
Partom, Y., Shock initiation modeling of multicomponent explosives, 14:31893 (R;US)
Pasa, A.A., *See* Oliveira, J.B.B., 14:31208
Pasciak, J. E., *See* Bramble, J. H., 14:33016
Pascual, R., *See* Biasi, R.S. de, 14:32795
See Silva, T.C.V. da, 14:31202
Pasha, I.I., *See* Afanasiev, V.L., 14:32455
Pasini, I., Comparative performance of fluorescent iron-core ballasts and electronic ballasts, 14:31076 (R;CA;In English and French)
Illumination evaluation, 14:31085 (R;CA;In French)
Performance evaluation of 3M Silverflux retrofit reflectors, 14:31077 (R;CA;In English and French)
Pasquini, E., Monitoring of a heat pump heat recovery system, 14:31055 (R;CA)
Passchier, W.F., *See* Vries, W. de, 14:31833
Patashnick, H., *See* Rupprecht, G., 14:30809
Pate, R. C., *See* Sanford, T. W. L., 14:32888
Patel, B., *See* DeLong, T., 14:30867
Patel, D., Photoluminescence in (Ga,In)P at high pressure, 14:31364 (J;US)
Paterson, J.M., *See* Deruyter, H., 14:31772
Patil, P.G., Recent developments in advanced lead-acid batteries for electric vehicle propulsion, 14:30965 (BA;US)
Patrick, P.H., Behavioural systems to guide or divert fish at hydroelectric facilities, 14:30699 (R;CA)
Patton, J., *See* Wertz, G.W., 14:32113
Paul, A.C., *See* Clark, J.C., 14:31729
Paul, A.V., Molecular events leading to poliovirus genome replication, 14:32110 (BA;US)
Paul, R., Theoretical interpretation of the anomalous behavior of some macromolecules, 14:31477 (BA;US)
Paulter, N. G., *See* Johnson, M. B., 14:31357
Pavlenko, O.P., *See* Bugaev, K.A., 14:32733
See Kaempfer, B., 14:32704
Pavlovsky, O.A., *See* Buldakov, L.A., 14:30912
Pawley, C., *See* Pronko, M., 14:32926
Pawlowska, B., Corrosion problems in manufacturing liquid fuels in fluidized catalytic (FCC) installations, 14:30295 (R;GB)
Payne, B.R., *See* Zhang Zhigan, 14:32055
Payne, P., *See* Loew, G., 14:32181
Peacock, H.B., *See* Woods, T.O., 14:31194
Pearson, D. H., *See* Hamdeh, H. H., 14:31251
Pearson, J., *See* Alesso, H.P., 14:32754
Pearson, M.D., Evaluation of the performance characteristics of radon and radon-daughter concentration measurement devices under controlled environmental conditions, 14:30705 (R;US)
Pease, J.H.B., Solution structure of apamin determined by nuclear magnetic resonance and distance geometry, 14:32357 (J;US)
Peaslee, D., *See* Blessing, S., 14:32559
See Boehnlein, A., 14:32564
Pebdani, F.N., *See* Cullick, A.S., 14:30294
Pechenkin, V.A., Recombination zone of Frenkel pairs in metals, 14:31212 (RA;SU;In Russian)
Peden, C.H.F., *See* Berlowitz, P.J., 14:31515
Pedersen-Lane, J., *See* Belfort, M., 14:32204
Peebles, C.L., Group II intron self-splicing: development of alternative reaction conditions and identification of a predicted intermediate, 14:32098 (BA;US)
Peebles, H. C., *See* Williamson, R. L., 14:31888
Pei, P.C., *See* Einerson, J.H., 14:32049
Pei-qi, L., *See* Cooper, R.S., 14:31458
Peinemann, K.V., *See* Koske, P.H., 14:31446
Peishel, F.L., Evolution of design concepts for remotely maintainable equipment racks, 14:31590 (RA;US)
Pekala, R.W., *See* Hopper, R.W., 14:31381
Pekay, L.A., *See* Olesik, S.V., 14:31399
Peleshko, V.N., *See* Krupnyj, G.I., 14:31742
Pellarin, D.J., *See* Hutcherson, M.N., 14:30508
Pellegrino, J.J., *See* Noble, R.D., 14:31426
Pelloux, R.M.N., *See* Andrade, A.H.P. de, 14:31204
Pelton, F., Report on modular hydropower demonstration, 14:30677 (R;US)
Pemberton, P.A., *See* Carrell, R.W., 14:32130
Peng, J. L., *See* Radousky, H. B., 14:31312
Penner, J.E., Cloud albedo, greenhouse effects, atmospheric chemistry, and climate change, 14:31975 (R;US)
Pennington, D.M., Observation of anomalous low J-value Stokes and anti-Stokes lines in stimulated rotational Raman scattering over long air paths, 14:31645 (BA;US)
See Henesian, M.A., 14:32887
Pennington, M. R., The search for scalar mesons, 14:32553 (J;US)
Penny, D., Reliability of evolutionary trees, 14:32163 (BA;US)
Pennycook, S.J., *See* Appleton, B.R., 14:31346
Pense, A.W., *See* Somers, B.R., 14:31190
Pensko, J., Measurement techniques for the estimation of the Rn-222 concentration and the exhalation rate indoors and outdoors using an activated carbon bed, 14:31826 (RA;AT)
Pepper, D.M., *See* Mullen, R.A., 14:31627
Peralta, G.L., Use of isotope techniques to investigate saltwater intruded aquifers in the Philippines, 14:32062 (RA;XA)
Perepech, K.V., *See* Dushin, V.N., 14:31576
Perera, R.C.C., *See* Berkeland, D.J., 14:32801
Perez, J.J., Optical fibers and sensors for chemistry, 14:31589 (R;FR)
Perlick, E., *See* Rotte, K.H., 14:32319
Perlman, P.S., *See* Peebles, C.L., 14:32098
Perry, R.E., Nuclear facility air lock design criteria, 14:30536 (R;US)
Person, L.S., *See* Johnson, T.C., 14:30633
Persoon, A.M., Electron-density depletions in the nightside auroral zone. Progress report, 14:32477 (R;US)
Persson, L., Chemical risks from nuclear waste repositories, 14:30626 (R;SE)
Perutz, M.F., Stereochemistry of cooperative mechanisms in hemoglobin, 14:32133 (BA;US)
Pesaran, A.A., Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems, 14:30758 (R;US)
Testing of novel desiccant materials and dehumidifier matrices for desiccant cooling applications, 14:31092 (R;US)
Pesic, M., *See* Antic, D., 14:30916
See Nikolic, D., 14:32751
Pessara, W., *See* Lauterbach, U., 14:31829
Peters, C., *See* Gilbert, W.S., 14:31765
Peters, P.E., *See* Reiser, M., 14:32312
Peters, R.R., *See* Nimick, F.B., 14:30581
Petersen, E.E., *See* Chmelka, B.F., 14:31508
Petersen, H.A., Nickel - iron battery, 14:31670 (R;DK;In Danish)
Petersen, H.G., *See* Flyvbjerg, H., 14:33005
Peterson, B. G., *See* Gray, K. J., 14:31238
Peterson, C.H., *See* Johnson, T.C., 14:30633
Peterson, C.J., *See* Capone, R.L., 14:30800
Peterson, D.E., *See* Arendt, P.N., 14:30811
Peterson, E.J., *See* Moody, D.C., 14:32348
Peterson, J., *See* Long, J.C.S., 14:32433
Peterson, J.M., Expediting cleanup at the Weldon Spring site under CERCLA and NEPA, 14:32026 (R;US)
Peterson, M.R., *See* Fulcher, J.N., 14:31951
Peterson, S.J., *See* Younker, L.W., 14:30612
Peterson, W.K., *See* Persoon, A.M., 14:32477
Petkov, D., *See* Lazarova, I., 14:32318

Petkova, V.B., Structure constants of the (A,D) minimal C less than 1 conformal models, 14:32629 (R;IT)
Petrizzi, L., *See* Anzidei, L., 14:32910
See Gallina, M., 14:32909
Petrov, G.A., *See* Laptev, A.B., 14:32749
Petrov, V. Y., *See* Diakonov, D. I., 14:32616
Petrov, V.K., *See* Borisenko, O.A., 14:32631
Petrov, Yu.V., Fast neutron contribution to nucleosynthesis reaction rates, 14:32456 (RA;SU;In Russian)
Petsko, G.A., *See* Alber, T.C., 14:32139
Pettersson, U., Coherence effects in parton showers, 14:32590 (R;SE)
Pettey, C.C., A theoretical investigation of a parallel genetic algorithm, 14:32985 (R;US)
Peyrard, M., Statistical mechanics of a nonlinear model for DNA denaturation, 14:32207 (J;US)
Pfaff, R.T., *See* Coleman, J.B., 14:33004
Pfeifer, K.B., A fiber optic test system for quantum efficiency measurements, 14:31875 (R;US)
Pfeiffer, H.J., Personal doses from beta radiation in Swiss nuclear power plants, 14:32775 (RA;AT;In German)
Pfitzinger, I., *See* Plueckthun, A., 14:32090
Pfueller, B., *See* Planitzer, J., 14:32275
Pfund, D.M., *See* Cochran, H.D., 14:31493
Pham, L. D., *See* Beise, E. J., 14:32658
Phelps, C.W., The development of a laser-driven spin-polarized dieuterium target, 14:31733 (R;US)
Philip, R.J., *See* Lee, G.K., 14:31680
Phillips, R. J. N., *See* Baer, H., 14:32578
Phillpot, S.R., *See* Lutsko, J.F., 14:31188
Phinney, N., *See* Bambade, P., 14:31730
Piacesi, R., *See* Marsh, G.E., 14:33015
Piacitelli, G., Industrial-hygiene survey report, Cain Chemical, Inc., Bayport Plant, Pasadena, Texas, June 1-2, 1988, 14:31953 (R;US)
Piasetzky, E., *See* Leitch, M. J., 14:32657
Piccirilli, J.A., *See* Benner, S.A., 14:32084
Piepel, G.F., A statistical approach for characterizing chemical durability within a waste glass compositional region, 14:31348 (J;US)
See Bates, S.O., 14:30573
Pierce, C.B., *See* Johnson, K.A., 14:31297
Pierce, J.D., *See* Allen, G.C., 14:30600
Pierce, P., *See* Yang, J., 14:31155
Pierce, R.D., *See* Krumpelt, M., 14:31049
Piesch, E., Phosphate glass dosimetry - after 25 years of routine use: new perspectives for personnel- and environment monitoring, 14:31838 (RA;AT;In German)
Pigford, T.H., *See* Light, W.B., 14:30567
Pilcher, G.E., A statistical analysis of measured river contamination at selected shoreline locations, 14:32053 (R;US)
Pimper, J.E., *See* Warshawsky, A.S., 14:33030
Pincus, M.R., Chain build-up procedure in computing the structures of biologically active polypeptides and proteins, 14:31977 (BA;US)
Pindzola, M. S., *See* Badnell, N. R., 14:32527
Pine, R.C., *See* Murphy, M., 14:31097
Pineau, J.F., *See* Schmitz, J., 14:31828
Pines, A., *See* Chmelka, B.F., 14:31508
Pinheiro, A.M.B.S., Adaptation of HAMMER computer code to CYBER 170/750 computer, 14:32991 (R;BR;In Portuguese)
See Corcuera, R.P., 14:30858
Pinsker, R., *See* Mayberry, M.J., 14:32871
Pinsker, R.I., High power ion Bernstein wave experiments on DIII-D, 14:32870 (R;US)
Pinsky, S., *See* Cline, J., 14:32639
Pinsky, S. S., *See* Bender, C. M., 14:32848
Pinto, N.G., *See* Bailey, C.B., 14:31442
Piotrowski, G.K., Evaluation of a resistively heated metal-monolith catalytic converter on a gasoline-fueled vehicle. Technical report, 14:31160 (R;US)
Piper, D.G., F/H Effluent Treatment Facility ECWPF pilot test, 14:30538 (R;US)
Pires, O.S., *See* Moura Neto, C., 14:31189
Piro, O., *See* Feingold, M., 14:32856
Pissarek, M., *See* Keller, T., 14:32267
Pitman, D., *See* Mir, R., 14:31852
Pitthan, R., *See* Adolphsen, C.E., 14:31776
Pitzer, D., *See* Schenk, W., 14:30906
Pizzuto, A., Construction and test results of the FTU toroidal magnet, 14:32911 (RA;IT)
See Andreani, R., 14:32908
See Migliori, S., 14:32906
Placet, M., Illustrative emission reduction scenarios, 14:31922 (R;US)
Placidi, M., *See* Burkert, V., 14:31734
Planitzer, J., Gd-DTPA in hypophyseal microadenoma diagnosis, 14:32275 (RA;DD;In German)
Optimization of Magnevist doses in NMR imaging of brain tumors, 14:32338 (RA;DD;In German)
See Harms, L., 14:32301
See Lehmann, R., 14:32299
See Michalik, M., 14:32238
See Planitzer, M., 14:32303
See Zschenderlein, R., 14:32248
Planitzer, M., MRT versus CT in tumors of skull base and lower brain stem, 14:32303 (RA;DD;In German)
Plantz, M.R., Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)
Platner, E.D., *See* Saulys, A.C., 14:31804
Pleva, Yu.S., *See* Laptev, A.B., 14:32749
Ploszajczak, M., *See* Okolowicz, J., 14:32705, 14:32707
Plueckthun, A., Engineering of antibodies with a known three-dimensional structure, 14:32090 (BA;US)
Plumb, G.R., *See* Corbet, A.D.W., 14:30471
Plummer, E. W., *See* Lui, S., 14:31262
Plyaskin, V.I., *See* Grudzevich, O.T., 14:32725
Pobylitsa, P. V., *See* Diakonov, D. I., 14:32616
Pocequilo, B.R.S., *See* Hiromoto, G., 14:30624
Pochettino, A., *See* Ordonez, S., 14:31210
Podolski, W.F., Metal wastage in fluidized-bed combustors, 14:30281 (R;US)
Podzimek, M., *See* Friberg, S.E., 14:30290
Poe, T.P., Feasibility of reducing or controlling predation induced mortality of juvenile salmonids in Columbia River reservoirs, 14:30684 (RA;US)
Predation by northern squawfish, walleye, smallmouth bass, and channel catfish in a mainstem Columbia River reservoir. I. Feeding ecology during the salmonid smolt out-migration, 14:30680 (RA;US)
See Vigg, S., 14:30681
Poenitz, W.P., The relationship between integral experimental data and nuclear fission parameters, 14:30857 (R;US)
Poeschl, A., *See* Bergemann, L., 14:32773
Poggio, A.J., Energy and Technology Review, February–March 1989, 14:32508 (R;US)
Pohani, B.P., *See* Hulsebos, J., 14:30360
Pohlenz-Michel, C., Investigation of the induction of oxidative DNA damage by means of an enzyme-linked immunosorbent assay (ELISA) for thymine glycol containing DNA, 14:32208 (R;DE;In German)
Polar, A., *See* Indacochea, J.E., 14:31274, 14:31275
Poletaev, E.D., *See* Kazahov, L.E., 14:32687
See Kononov, V.N., 14:32686
Poletti, A.R., *See* Stuchbery, A.E., 14:32678
Poletti, S.J., *See* Stuchbery, A.E., 14:32678
Politowicz, P.A., Influence of swelling on reaction efficiency in intercalated clay minerals, 14:31530 (J;US)
Pollack, S.J., Antibody catalysis by transition state stabilization, 14:32089 (BA;US)
Pollinger, J.P., *See* Ellingson, W.A., 14:31272
Polyachenko, V.L., *See* Afanasiev, V.L., 14:32455
Pommert, A., *See* Hoehne, K.H., 14:32320
Pon, C.J., Aeolian vibration excitation of bundle conductors. Vol. 1 and 2, 14:30815 (R;CA)
Pon, C.L., *See* Nierhaus, K.H., 14:32146
Ponder, J.W., Internal packing and protein structural classes, 14:32120 (BA;US)
Ponte, M.A. de., *See* Assuncao Matos, H. de, 14:32216

Poore, A.V., Documentation for users: Audience, content, and language, 14:33023 (R;US)
Pope, L.E., *See* Cross, J.B., 14:31331
Pople, J. A., *See* Ruscic, B., 14:31479
Popov, Yu.P., *See* Vtyurin, V.A., 14:32731
Popovic, B., *See* Noemmik, H., 14:32003
Popovic, D., Radiation burden of a critical group of children by K-40 taken by food, 14:32383 (RA;AT)
Popovici, D., *See* Georgescu, S.A., 14:32291
Porch, W. M., Blue moons and large fires, 14:31980 (J;US)
Porkolab, M., *See* Mayberry, M.J., 14:32871
See Pinsker, R.I., 14:32870
Porodzinskij, Yu.V., *See* Klepatskij, A.B., 14:32690
Porquet, M.G., *See* Roussiere, B., 14:32669
Porrati, M., *See* Erber, T., 14:32844
Porta, J.J., On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)
Portal, J.C., *See* Basmaji, P., 14:32789
Potanina, T.D., *See* Ignatochkin, A.E., 14:32712
Pothe, H., *See* Kachel, R., 14:32333
Potrin, J.-Y., A computer system for the design and experimentation of routing algorithms, 14:31096 (R;CA)
Potts, M., *See* Spencer, T., 14:30732
Poukey, J. W., *See* Sanford, T. W. L., 14:32888
Poukey, J.W., Numerical simulations of RADLAC, IBEX, Recirc, and PT0 in 1988, 14:31767 (R;US)
Poulsen, F.W., Impressions of the Japanese Sunshine and Moonlight projects, 14:30989 (R;DK)
Pound, B.G., *See* Summers, D.P., 14:31046
Poupeau, G., Geochronology and geochemistry by nuclear tracks method: some utilization examples in geologic applied, 14:32412 (R;BR;In Portuguese)
Povyshev, V.M., *See* Golubev, A.I., 14:32504
Powell, A.C., *See* Balchunas, A.T., 14:31443
Powell, D.E., Examination of pits in Trojan nuclear power plant steam generator tubes: Final report, 14:30840 (R;US)
Powell, E.T., *See* Levinton, F.M., 14:32882
Powell, K., *See* Chrostek, W.J., 14:31944
Powers, D.A., Validation of core debris/concrete interactions and source term models, 14:30921 (R;US)
Powers, T., *See* Holler, H.F., 14:32149
Prado, F.R., Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)
Prasad, N.R., *See* Ranade, S.J., 14:30749
Prasad, R., *See* Sengupta, A., 14:31434
Prasertdham, P., *See* Vanichseni, S., 14:30400
Prasza@rl@xXowicz, M., *See* Diakonov, D. I., 14:32616
Prater, G.S., Analysis of four selected state-transportation coordinated efforts in social services and rural public transportation. Final report, 14:31099 (R;US)
Prater, R., *See* Pinsker, R.I., 14:32870
Prati, A., Implantation of multigroup diffusion code 2DB in the IEAv CDC CYBER 170/750 system, and its preliminary evaluation, 14:30861 (R;BR;In Portuguese)
Pregenzer, A. L., *See* Sanford, T. W. L., 14:32888
Prelas, M.A., *See* Wallace, C.B., 14:32933
Premuzic, E.T., Developments in geothermal waste treatment biotechnology, 14:30766 (R;US)
See Sundaram, M.S., 14:30245
Prendergast, L.A., *See* Poe, T.P., 14:30680
See Vigg, S., 14:30681
Prescher, A., *See* Bohndorf, K., 14:32316
Prestwich, K.R., *See* Ramirez, J.J., 14:32930
Priano, C., Evolution of the RNA coliphages: the role of secondary structures during RNA replication, 14:32108 (BA;US)
Priatko, G.J., A hybrid 3 Gs/s, 6-bit digital to analog converter, 14:31678 (R;US)
Price, D. L., *See* Loong, C., 14:31302
Price, J.H., Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana, 14:31947 (R;US)
Price, J.V., *See* Been, M.D., 14:32093
Price, P. B., *See* Moody, K. J., 14:32693
Price, R.T., *See* Fish, R.H., 14:30706
Prieto, S., Concentrated acid hydrolysis with acid recovery, 14:30662 (RA;US)
Printz, H., *See* Sauermann, P.F., 14:31700
Prinz, G. A., *See* Idzerda, Y. U., 14:31247
Pritchard, D.E., *See* Martin, A.G., 14:32487
Pronin, O.D., *See* Anikejchik, A.M., 14:31743
Pronko, M., Efficient second harmonic conversion of broadband high-peak-power Nd:glass laser radiation using large-aperture KDP crystals in quadrature, 14:32926 (R;US)
Prono, D.S., High average-power induction linacs, 14:31707 (R;US)
Pronyaev, V.G., *See* Ignatyuk, A.V., 14:32728
Protopopescu, S. D., *See* Boehnlein, A., 14:32564
See Chung, S. U., 14:32566
Prouza, Z., *See* Rimpler, A., 14:32777
Pruett, D.J., *See* Ensor, D.D., 14:31418
Pruss, F., *See* Finger, S.M., 14:30506
Prussin, S.G., *See* Failor, R.A., 14:32962
Puckett, E. G., Convergence of a random particle method to solutions of the Kolmogorov equation $u_t = \nu u_{xx} + u(1-u)$, 14:33019 (J;US)
Puiffoulloux, C., *See* Lamarque, J.L., 14:32293
Puigdomenech, I., Modelling uranium solubilities in aqueous solutions: Validation of a thermodynamic data base for the EQ3/6 geochemical codes, 14:31577 (R;SE)
Pujol, J., *See* Lamarque, J.L., 14:32293
Pulsipher, B.A., *See* Kuhn, W.L., 14:30572
Purmann, H., *See* Hunsdiek, F.W., 14:32337
Pusch, R., Rock sealing - interim report on the rock seealing project (stage 1), 14:30608 (R;SE)
Putterman, S., *See* Erber, T., 14:32844
Puura, V., Conditions of kukersite deposition, 14:30331 (RA;CN)
See Kattat, V., 14:30334

Q

Qian, H., New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)
Qian, J., *See* Wang, J., 14:30341
See Wang, X., 14:30398
Qin, K., Mechanism of hydrocarbon generation from fushun oil shale kerogen as viewed by high field solid state C-13 n.m.r. spectroscopy, 14:30387 (RA;CN)
See Lu, Q., 14:30345
See Lu, S., 14:30385
See Zhu, Z., 14:30361
Qin, R., *See* Wang, Z., 14:30332
Que, Y., *See* Chen, Y., 14:30401
Quick, C. R., *See* Tang, C. Y., 14:32525
Quigley, J. H., *See* Patel, D., 14:31364
Quinn, J., *See* Wu, S. C., 14:31260
Quiocho, F.A., Atomic protein structures reveal basic features of binding of sugars and ionic substrates, and calcium cation, 14:32123 (BA;US)
Qvale, B., The Danish aquifer thermalenergy storage program, 14:30944 (RA;CA;In English and French)
See Sorensen, S.N., 14:30953

R

Rabideau, P.W., Dissolving metal reduction of aceanthrylene and NMR analysis of a rigid, boat-shaped 9,10-dihydroanthracene, 14:31484 (J;US)
See Marcinow, Z., 14:31495, 14:31496
Rabin, M., *See* Hartouni, E. P., 14:32561
Rabitsch, H., /sup 131/I-activity in man's thyroid and /sup 137/Cs-activity in muscle tissue, 14:32014 (RA;AT;In German)
Rabl, A., *See* Norford, L.K., 14:31038
Rachidi, I. E., *See* Wang, E., 14:31378
Rack, E.P., *See* Blotcky, A.J., 14:31459
Radeka, V., *See* Debbe, R., 14:31803
Radke, C.J., *See* Chmelka, B.F., 14:31508
See Jahnke, F.M., 14:31353

Radmilovic, V., Lithium depletion in precipitate free zones (PFZ's) in Al-Li base alloys, 14:31239 (J;US)
Rado, V., *See* Anzidei, L., 14:32910
See Franconi, E., 14:32913
See Gallina, M., 14:32909
Radousky, H. B., Preparation and Raman analysis of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$, 14:31312 (J;US)
Radovic, Z., *See* Thiemann, S. L., 14:32817
Radusewicz, P., *See* Akerlof, C., 14:32462
Rafferty, K.D., Absorption refrigeration, 14:30779 (RA;US)
Aquaculture, 14:30781 (RA;US)
Greenhouses, 14:30780 (RA;US)
Heat exchangers, 14:30776 (RA;US)
Heat pumps, 14:30778 (RA;US)
Piping geothermal fluids, 14:30771 (RA;US)
Space heating equipment, 14:30777 (RA;US)
See Culver, G., 14:30770
Ragan, H.A., *See* Filipy, R.E., 14:32376
Raghavaiah, C.V., *See* Sastry, D.L., 14:32498
Rago, C.E., *See* Deruyter, H., 14:31772
Rahal, V., *See* Campa, A., 14:32613
Rahim, H., Dosimetry and radiation risk in diagnostic radiological examinations of the lumbosacral region of the spine: computerized tomography versus functional myelography, 14:32388 (RA;AT)
Rai-Choudhury, P., *See* Dutta, S., 14:31340
Raju, R., *See* Kolakofsky, D., 14:32114
Rak, S.F., *See* Kenny, P.W., 14:31509
Raldow, W., Heat pump - a technical system in progress, 14:31616 (R;SE;In Swedish)
Ramaiah, D., Phototransformations of benzopyranols and related systems. Steady-state and laser flash photolysis studies, 14:31555 (J;US)
Raman, N., *See* Achuthan, P.V., 14:31383
Ramanujam, A., *See* Achuthan, P.V., 14:31383
Ramirez, J.J., Performance of the Hermes-III gamma ray simulator, 14:32930 (R;US)
See Alexander, J.A., 14:31701
See Denison, G.J., 14:32931
Ramos, A. and others, *See* Ianzos, E., 14:32220
Ramqvist, G., *See* Pusch, R., 14:30608
Ranade, S.J., Islanding in dispersed, utility-interactive photovoltaic systems, 14:30749 (R;US)
Randic, M., Characterization of three-dimensional structures, 14:31478 (BA;US)
Rational selection of graph-theoretical indices in the QSAR, 14:32194 (BA;US)
Randle, A.C., *See* Reeg, C.P., 14:30362
Randolph, J.D., *See* DeMuth, S.F., 14:30446
Rankin, P., *See* Boyarski, A., 14:31854
Rankin, W.N., Communication in hazardous environments, 14:31592 (RA;US)
Rantanen, K., *See* Kosola, J., 14:30813
Rao, G.S., Conformational basis of the receptor-binding potency of normal and mutant insulin molecules with relevance to the pathophysiology of noninsulin dependent diabetes mellitus (NIDDM), 14:32184 (BA;US)
Rao, P.S., Sorption of selected volatile organic constituents of jet fuels and solvents on natural sorbents from gas and solutions phases. Final report, April 1985-September 1987, 14:30298 (R;US)
Raposo, M.I.B., Magmatic and petrologic evolution of the mesozvic vulcanic acid rocks from Piraju-Ourinhos region (SP-PR), 14:32414 (R;BR;In Portuguese)
Rard, J.A., Ternary mutual diffusion coefficients of NaCl-$SrCl_2$-H_2O at 25°C. 2. Total concentrations of 2.0 and 3.0 $mol \times dm^{-3}$, 14:31532 (J;US)
Raridon, R.J., *See* Whealton, J.H., 14:32901
Rashid, Y.R., An estimate of the contribution of spent fuel products to the releasable source term in spent fuel transport casks, 14:30586 (R;US)
Rashin, A.A., Continuum electrostatics and hydration phenomena, 14:32186 (BA;US)
Rasmussen, C.E., *See* Bos, A.J.J., 14:31841
Rasmussen, D.A., *See* Arunasalam, V., 14:32881
See Langley, R.A., 14:32899
Rastberger, S.B., *See* Day, J.E., 14:30467
Rastsvetalov, Ya.N., *See* Krupnyj, G.I., 14:31742
Ratcliff, M., *See* Chum, H.L., 14:30736
Ratcliff, M.A., Catalyst development for hydrodeoxygenation and dealkylation of lignins for fuels, 14:30735 (RA;US)
Ratilla, E.M.A., Guanidyl groups: new metal-binding ligands in biomolecules. Reactions of chloro(2,2':6',2"-terpyridine)platinum(II) with arginine in two cytochromes c and with other guanidyl ligands, 14:31505 (J;US)
Ratzel, A.C., *See* Geller, A.S., 14:31896
Rau, P., *See* Batheja, P., 14:30825
Raubenheimer, T.O., A formalism and computer program for coupled lattices, 14:31793 (R;US)
Analytic estimates of coupling in damping rings, 14:31794 (R;US)
Ravenscroft, D., *See* Prono, D.S., 14:31707
Rawlings, K.J., *See* Kingdon, R.D., 14:31861
Ray, R., The fermilalb E-760 charmonium detector, 14:31857 (J;US)
Ray, S.L., Characterization of radiation boundary conditions used in the finite-difference time-domain method, 14:32840 (R;US)
Rayburn, T.F., *See* Langley, R.A., 14:32899
Razaq, A., *See* Razaq, M., 14:31047
Razaq, M., Electrochemical characteristics of acid electrolytes for fuel cells. Final report, August 1, 1985-December 31, 1988, 14:31047 (R;US)
Razbudej, V.F., *See* Vertebnyj, V.P., 14:32691
Rea, K., *See* Bloom, I., 14:31052
Read, J., Planning for electric utilities; the value of service, 14:31020 (RA;US)
Reagan, D., *See* Rolfe, J., 14:31779
Reale, F., *See* Carotenuto, A., 14:30937
Reanney, D.C., Genetic error and genome design, 14:32154 (BA;US)
Reardon, P.C., *See* Finley, N.C., 14:30594
Recami, E., Fifth force, sixth force and all that. A theoretical (classical) approach, 14:32821 (R;IT)
Rechen, J., *See* Gilbert, W.S., 14:31765
Reddy, K.J., *See* Sullivan, P.J., 14:30420
Redey, L., *See* Bloom, I., 14:31052
Redfern, P., *See* Hirata, F., 14:31476
Redwine, R. P., *See* Beise, E. J., 14:32658
Reed, C.E., *See* Giergiel, J., 14:31462
Reed, D.L., Characterization of radioactive waste forms. Progress report for 1986 Volume 2, 14:30554 (R;FR)
Reed, J.H., Analysis of water heater data from Athens load control experiment, 14:30819 (J;US)
Reed, R.P., The PVDF [polarized polyvinylidene fluoride polymer film] piezoelectric polymer shock-stress sensor: Signal conditioning and analysis for field test application, 14:31865 (R;US)
See Moore, L.M., 14:31892
Reeder, R. A., *See* Tang, C. Y., 14:32525
Reedy, R.C., *See* Arnold, J.R., 14:32458
Reeg, C.P., Unocal Corporation's commercial experience in upgrading shale oil to produce a high quality syncrude, 14:30362 (RA;CN)
Rees, J.H., *See* Angus, M.J., 14:30463
Reffstrup, J., *See* Soereide, I., 14:30393
Regan, L., *See* DeGrado, W.F., 14:32129
Rehn, L. E., *See* Sharma, R. P., 14:31349
Rehn, L.E., *See* Meng, W.J., 14:31185
Reich, C., *See* Pace, N.R., 14:32100
Reich, W.J., *See* McBride, A.F., 14:30571
Reichley-Yinger, L., Recovery of plutonium and americium from chloride salt wastes by solvent extraction, 14:30431 (J;US)
See Chaiko, D.J., 14:31420
Reichmuth, B., Dynamic computerized tomography of the brain, 14:32334 (RA;DD;In German)
See Schulz, W., 14:32240
Reimann, K.J., *See* Podolski, W.F., 14:30281
Reimus, M.A.H., *See* Piepel, G.F., 14:31348
Rein, V., Aspects of nonfuel utilization of oil shales based on their oxidation, 14:30395 (RA;CN)
Reiser, M., Value of Gd-DTPA in NMR imaging of inflammatory and neoplastic skeletal diseases, 14:32312 (RA;DD;In German)
Reisman, A., *See* Williams, C. K., 14:31351
Reitsma, B.H., *See* Wroblewski, A.E., 14:31497

Reitz, G., *See* Buecker, H., 14:32760
Reizenstein, P., *See* Olsson, S.E., 14:30925
Rej, D.J., Design and performance of the 10-kV, 5-MA pulsed-power system for the FRX-C compression experiment, 14:32923 (R;US)
Remarks before the Beiji, *See* Rusche, B.C., 14:31003
Rempp, H. D., *See* Heffner, R. H., 14:31252
Renfro, L.J., *See* James, D.W., 14:30470
Rengan, A., *See* Krishnaswamy, J., 14:31359
Renier, J.P., *See* Brady, M.C., 14:30588
See Hermann, O.W., 14:30569
Renieri, A., Free electron lasers. Status and perspectives, 14:32914 (RA;IT)
Renlund, A.M., *See* Trott, W.M., 14:31527
Renner, J.L., *See* Stiger, S.G., 14:30769
Rennich, M.J., A cask maintenance facility feasibility study, 14:30525 (R;US)
Reno, H.W., TMI-2 reactor fuel removal, loading, transport, and storage, 14:30898 (RA;US)
Repalov, I.N., Variation methods in the theory of the plasma bunches oscillations, 14:32878 (R;SU;In Russian)
Rescia, S., *See* Debbe, R., 14:31803
Reubel, B., Biophysical test methods for radioprotectors, 14:32379 (RA;AT)
Reuter, W.G., *See* Lloyd, W.R., 14:31195
Rex, R.C. Jr., *See* Dyni, J.R., 14:30383
Reynoso, F.A., *See* Knudson, D.M., 14:30984
Rhee, Y., *See* Hautman, J., 14:31483
Rheinberger, H.J., *See* Nierhaus, K.H., 14:32146
Rhodes, C., *See* Zaidi, A., 14:31682
Rhodes, C.K., *See* Cullen, D., 14:31626
Rhodes, D., *See* Klug, A., 14:32124
Rhue, R.D., *See* Rao, P.S., 14:30298
Ribeiro, J.P., *See* Jesus, A.P., 14:32499
Rice, B.W., *See* Stallard, B.W., 14:32886
Rice, J.E., *See* Yates, B.F., 14:31534
Richards, B., Electicity supply voltage problems, 14:30817 (R;CA)
Richards, D. R., *See* Loong, C., 14:31302
Richards, D.R., *See* Dabrowski, B., 14:31270
Richards, F.M., *See* Ponder, J.W., 14:32120
Richards, N.G.J., Electrostatics and molecular recognition, 14:32183 (BA;US)
Richardson, R.V., Pneumatically operated grapple for handling nuclear waste packages, 14:30496 (RA;US)
Richerson, F.B., Economic evaluation of pretreatment and non-pretreatment vendor size tests and costs for commercialization of the continuous enzymatic SSF for production of ethanol from cellulose waste, 14:30665 (RA;US)
Richter, K., *See* Cobet, H., 14:32287
Rickelton, W.A., Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
Rickert, P.G., *See* Nash, K.L., 14:31571
Ridgel, J.G., Radwaste evaporator operating experience at Callaway Nuclear Plant, 14:30551 (RA;US)
Rief, D.J., Restoring solvent for nuclear separation processes, 14:30444 (J;US)
Rieman, B.E., Population dynamics of northern squawfish and potential predation on juvenile salmonids in a Columbia River reservoir, 14:30688 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part IV. Estimated total loss and mortality of juvenile salmonids to northern squawfish, walleye, and smallmouth bass, 14:30687 (RA;US)
See Beamesderfer, R.C., 14:30686, 14:30690, 14:30695
See Connolly, P.J., 14:30689
See Poe, T.P., 14:30684
Riemer, M., *See* Hoehne, K.H., 14:32320
Rienmueller, R., Results of NMR imaging in postsurgical follow-up of heart transplantation patients, 14:32279 (RA;DD;In German)
Rigano, J.N., *See* Gill, J.T., 14:32954
Riik, *See* Yefimov, V.M., 14:30356
Riles, J.K., A search for close-mass lepton doublet, 14:32548 (R;US)
Riley, D., *See* Willi, O., 14:32896
Rimpler, A., Calibration and intercomparison of neutron moderation spectrometers, 14:32777 (R;DD)
Rinck, P., Differential diagnosis of white substance alterations by NMR imaging, 14:32243 (RA;DD;In German)
Medical applications of field cycling relaxometry, 14:32229 (RA;DD)
Ringe, D., *See* Alber, T.C., 14:32139
Ringler, K.G., *See* Erven, C.C., 14:30814
Rinkus, R. -M., *See* Johnson, S. A., 14:31415
Risa, R., Position controllable working platform in derricks, 14:31689 (R;NO;In Norwegian)
Ristic, D., *See* Markovic, P., 14:32750
Ritchie, R. H., *See* Zheng, X., 14:32815
Ritson, D., *See* Bambade, P., 14:31723
Rivard, A., *See* Vosikovsky, O., 14:31196
Rivard, D., Vocabulary of acid precipitation and air pollution. Terminology bulletin 175, 14:31970 (R;CA;In English and French)
Rivas, J., *See* Linzama, H., 14:30429
Rivera, M., *See* Oakes, M., 14:32147
Robbins, C.L., *See* Weaver, N.L., 14:31091
Robbins, G.A., Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987, 14:30256 (R;US)
See Winschel, R.A., 14:30246, 14:30252, 14:30253, 14:30254, 14:30255, 14:30257, 14:30258, 14:30259
Roberts, B., Volume reduction program at Crystal River Unit #3, 14:30547 (RA;US)
Roberts, D.W., *See* Levinton, F.M., 14:32882
Roberts, J.C., *See* Cole, D.A., 14:32349
Roberts, J.M., Capillary gas chromatographic separation of alkyl nitrates and peroxycarboxylic nitric anhydrides, 14:31411 (J;US)
Roberts, J.T., Reactions of ethanethiol on Mo(110): formation and decomposition of a surface alkyl thiolate, 14:31514 (J;US)
Roberts, P.T., *See* Angus, M.J., 14:30463
Roberts, S., Convergence of a random walk method for the Burgers equation, 14:33018 (J;US)
Robertson, B.C., Stefan-Maxwell analysis of protein transport in porous membranes, 14:31437 (J;US)
Robertson, J. L., *See* Kan, X. B., 14:31363
Robertson, J.R., *See* Jacob, N.P., 14:30457
Robinson, G. Y., *See* Patel, D., 14:31364
Robinson, J.E., Development of gas-bearing reservoirs in the Trenton Limestone Formation of New York. Final report, 14:30316 (R;US)
Robinson, P., Classification system for low level radioactive waste disposal technologies, 14:30546 (RA;US)
EPRI 1986 LLW program, 14:30550 (RA;US)
Robinson, P.D., *See* Dunkerton, L.V., 14:31487
Robinson, P.J., *See* Jacob, N.P., 14:30457
Robinson, R., *See* Shore, S.N., 14:32453
Robinson, S.L., *See* Whalen, R.T., 14:31241
Robinson, S.M., *See* Collins, E.D., 14:30459
Robinson, W.A., Efficacy of alfa-interferon as coadjuvant therapy of melanoma stage II, 14:32218 (RA;BR;In Spanish)
Robson, B.A., *See* Hebbard, D.F., 14:32695
Rocamora Junior, F.D., *See* Leite, S.B., 14:30862
Rockstroh, G., Quality control in computerized tomography, 14:32235 (RA;DD;In German)
Rockwood, L., Scientific basis for risk assessment and legal aspects of compensation of claims related to occupational and non-occupational radiation exposure, 14:30911 (RA;AT)
Roddy, J.W., *See* Hermann, O.W., 14:30569
See McBride, A.F., 14:30571
Roderick, N.F., *See* Hussey, T.W., 14:31631
Rodger, E., [Coil production facilities, Karlsruhe, Germany and Bagneux, France, May 8–10, 1989]: Foreign trip report, 14:31736 (R;US)
Rodrigues, S., X-ray diffraction identification of clay minerals by microcomputer, 14:32430 (R;BR;In Portuguese)
Rodrigues-Costa, C., Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Roedel, G., *See* Tofani, P.C., 14:30890
Roehl, N.M., *See* Klausner, J.C., 14:32792
Roemer, T., MRT and CT of the esophageal cancer, 14:32252 (RA;DD;In German)
See Gewiese, B., 14:32269
See Stiller, D., 14:32270
Roemer, T. J., *See* Sanford, T. W. L., 14:32888

Roennberg, G., Power ramp irradiation of AA test fuel rods OA1-1,-2,-3,-4 and OL1-1, -4: The Super-Ramp Extension Project, 14:30830 (R;SE)
Rofer, C.K., The destruction of hazardous chemical waste by oxidation in supercritical water, 14:32036 (R;US)
Rogan, E.G., *See* Zamzow, D., 14:32402
Rogers, R.D., *See* McConnell, J.W. Jr., 14:30468
Rogers, V.C., Radon generation, adsorption, absorption, and transport in porous media, 14:31062 (R;US)
Roginski, R.T., High-pressure spectroscopic studies of ferrocene, nickelocene, and ruthenocene, 14:31503 (J;US)
Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene, 14:31504 (J;US)
Roginsky, J., *See* Letaw, J.R., 14:32443
Rognlien, T.D., *See* Stallard, B.W., 14:32886
Rohatgi, P.K., *See* Wu, W., 14:31269
Rohwein, G.J., An SCR-switched, high voltage, high gain linear transformer system, 14:31674 (R;US)
Roithova, Z., Abdominal sympathetic tumours complex CT diagnosis, 14:32305 (RA;DD)
Rokni, S. H., *See* Leitch, M. J., 14:32657
Roldao, M., *See* Trindade, M.C., 14:32219
Rolfe, E.J, Decade of UV astronomy with the IUE satellite. Volume 1. Proceedings of a celebratory symposium, 14:32446 (R;FR)
Rolfe, E.J., Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium, 14:32445 (R;FR)
Rolfe, J., Long ion chamber systems for the SLC [Stanford Linear Collider], 14:31779 (R;US)
Romanov, V.A., Development of charging belt for electrostatic accelerators, 14:31738 (R;SU;In Russian)
Romero, L.A., *See* Ghiglia, D.C., 14:31607
Romig, A.D. Jr., *See* Cieslak, M.J., 14:31227
Ronan, M. T., Vector-vector production in photon-photon interactions, 14:32563 (J;US)
Ronan, M.T., Timing and rf synchronization for filling PEP/SPEAR with the SLC Damping Rings, 14:31792 (R;US)
Rongyi, Z., *See* Baizhong, Z., 14:30949
Rooks, *See* Yefimov, V.M., 14:30356
Roots, T., *See* Nawwar, A.M., 14:31663
Roriz, R., *See* Bellet, M., 14:32215
Rosa, G., *See* Viragh, E., 14:30883
Roschke, M.A., Xcl—A family of programming lanquage-based shells, 14:33003 (R;US)
Rose, H. A., *See* Cheung, P. Y., 14:32480
Roseberry, L.M., An expert system to facilitate selecting a database management system, 14:32989 (R;US)
Rosen, J. L., Does the η meson bind to other hadrons?, 14:32598 (J;US)
Rosen, S. P., Neutrino-electron scattering and the choice between different Mikheyev-Smirnov-Wolfenstein solutions of the solar neutrino problem, 14:32470 (J;US)
Rosenau, P., Extension of Landau-Ginzburg free-energy functionals to high-gradient domains, 14:32541 (J;US)
Rosenberg, N., *See* Edmonds, J., 14:31920
Rosencrans, R.D., *See* Shadle, L.J., 14:30347
Rosenfeld, R., *See* Goble, R. L., 14:32608
Rosenkranz, G., Quantitative evaluation of dynamic computed tomograms in liver cirrhosis, 14:32225 (RA;DD;In German)
Studies on lens and gonad radiation doses in computerized tomography, 14:32759 (RA;DD;In German)
See Tellkamp, H., 14:32246
Rosenkranz, M., *See* Freitag, J., 14:32256
Rosensteel, R.E., Health-hazard evaluation determination report No. 74-9-174 Wheeling Steel Corporation, Steubenville, Ohio, 14:31961 (R;US)
Rosenstock, W., *See* Schulze, J., 14:31846
Rosner, J. L., Aspects of top-quark searches in TeV hadron collisions, 14:32576 (J;US)
See Goble, R. L., 14:32608
Ross, M., *See* Rolfe, J., 14:31779
Ross, M.C., *See* Ronan, M.T., 14:31792
Ross, P., Quality demands and methods of control in the case of welded plastic-casing pipe joints. Part 1, 14:31334 (R;DK;In Danish)
Ross, P.N., Metal/zirconia interfacial reactions in solid oxide fuel cell anodes, 14:31048 (BA;US)
Ross, W.A., Evaluation of treatment alternatives for wastes from both spent fuel rod consolidation and miscellaneous commercial activities, 14:30473 (RA;US)
Rossiter, J.F.B., *See* Morgan, T.L., 14:32393
Rossmanith, R., *See* Burkert, V., 14:31734
Rossmassler, R.L., A tritium compatible plasma exhaust system for a large tokamak, 14:32942 (J;US)
See Sissingh, R.A.P., 14:32945
Rostand, R.E., *See* Chrostek, W.J., 14:31943
Roster, B., *See* Ronan, M.T., 14:31792
Rosu, V., *See* Pana, I., 14:32342
Roth, E.P., Thermophysical properties of advanced carbon materials for Tokamak limiters, 14:32929 (R;US)
Rothberg, J. E., *See* Hearty, C., 14:32577
Rothe, W., External occupational radiation exposure in the GDR in 1987, 14:32778 (R;DD;In German)
Rotte, K.H., Value of CT in monitoring preoperative chemotherapy of osteosarcomas, 14:32319 (RA;DD;In German)
See Stuerzer, I., 14:32314
Roturier, J., *See* Norford, L.K., 14:31038
Rouanet, J.P., *See* Lamarque, J.L., 14:32293
Roukos, N., *See* Caramanis, M.C., 14:31035
Rouse, F., *See* Kent, J., 14:31778
See Levi, M., 14:31777
Rousseau, J.-M., *See* Potrin, J.-Y., 14:31096
Roussiere, B., Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)
Roussin, R.W., *See* McBride, A.F., 14:30571
Routbort, J.L., *See* Wu, W., 14:31269
Roux, Y., *See* Le Grand, J., 14:32766
Rovetta, M. R., An experimental study of hydroxyl in quartz using infrared spectroscopy and ion microprobe techniques, 14:30761 (J;US)
Rovira, D., *See* Robinson, W.A., 14:32218
Row, K.H., *See* Griest, W.H., 14:31444
Rowe, J. E., *See* Kilcoyne, A. L. D., 14:31259
Rowe, M.S., Brookhaven Highlights, October 1, 1987–September 30, 1988, 14:30986 (R;US)
Roy, G., Effect of the fringing field in sector bending magnets: the coupling of the transverse planes in the solutions of the equation of motion at second-order, 14:32880 (R;FR)
Roy, N., Electromagnetic decay of 10/sup +/ states and yrast isomers in /sup 208/Pb, 14:32682 (J;NL)
Royet, J., Straight ends for superconducting dipole magnet using "constant perimeter" geometry, 14:31764 (R;US)
See Gilbert, W.S., 14:31765
Rozsnyai, B.F., [Symposium on the Auger Effect, Paris, Orsay, and Limeil, France, March 29–30, 1989 and April 3–7 and 20–21, 1989]: Foreign trip report, 14:32492 (R;US)
Ruchti, R.C., Scintillating fiber detector development for the SSC: Annual progress report, 14:31810 (R;US)
Ruf, H., *See* Dick, R., 14:31392
Rummel, S., *See* Emery, K.A., 14:30738
Ruppert, M., Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)
Rupprecht, G., TEOM(trade mark) real-time carbon-concentration monitor. Final report, 14:30809 (R;US)
Rusche, B.C., Remarks before the Beijing meeting of the pacific basin conference, 14:31003 (J;US)
Ruscic, B., The ethyl radical: Photoionization and theoretical studies, 14:31479 (J;US)
Russell, D., *See* Cheung, P. Y., 14:32480
Russell, D.H., *See* Kerley, E.L., 14:31398
See Tecklenburg, R.E. Jr., 14:31401
Russell, E., *See* Nelson, T., 14:30610
Ruth, R.D., Report on the international workshop on next generation linear colliders, 14:31706 (R;US)
See Bane, K.L.F., 14:31791
See Gabella, W.E., 14:31728

See Lavine, T.L., 14:31768
See Raubenheimer, T.O., 14:31794
See Thompson, K.A., 14:31724
Ryabykh, Yu.I., *See* Lapenas, A.A., 14:32649
Ryan, J., *See* Clayton, R., 14:30810
Ryan, J.P., *See* Klein, K., 14:31669
Ryan, M.A., *See* Spitler, M.T., 14:31293
Ryan, P.M., *See* Whealton, J.H., 14:32901
Ryding, E., Measurement of regional cerebral blood flow by intravenous administation of 133 xenon. Theory, technique and clinical applications, 14:32360 (R;SE)
Ryerson, F. J., Oxygen diffusion in olivine: Effect of oxygen fugacity and implications for creep, 14:32436 (J;US)
Rygier, D., *See* Zaidi, A., 14:31682
Rymas, S.J., *See* Gray, J., 14:31905
Ryoo, R., *See* Chmelka, B.F., 14:31508
Ryutova, M.P., Negative energy waves in magnetic flux tubes, 14:32876 (R;SU)

S

Saad, E., *See* Feng, X., 14:30522
Saavedra, A., *See* Biasi, R.S. de, 14:32795
Sabate, J., Radiology of lobular carcinoma of breast in situ, 14:32214 (RA;BR;In Spanish)
Radiology of medullar carcinoma of breast, 14:32213 (RA;BR;In Spanish)
Sabin del V, J., *See* Dios L, M. de, 14:32822
Sabljic, A., *See* Klasinc, L., 14:31397
See Randic, M., 14:32194
Sacchetti, M., *See* Ferro, C., 14:32912
Sacilotti, M.A., *See* Iikawa, F., 14:31207
Sack, J.S., *See* Quiocho, F.A., 14:32123
Sadakane, K., *See* Takada-Hidai, M., 14:32451
Sadleir, R.B., *See* Woods, C.L., 14:32661
Sadovoj, A.A., *See* Golubev, A.I., 14:32504
Safron, S. A., *See* Chern, G., 14:31374
Sagel, S.S., CT and MRI in the evaluation of bronchogenic carcinoma, 14:32283 (RA;DD)
CT and MRI of kidney, adrenal and abdominal lymph nodes, 14:32290 (RA;DD)
Saha, B., *See* Karunasagar, D., 14:31447
Sahai, Y., Review of airglow observations at equatorial and low-latitudes in the Brazilian sector, 14:32476 (RA;BR)
Sailer, R., Experimental study on the usefulness of magnetotherapy in bone fractures (tibial osteotomy in the rat). Accumulation of 99 mTc MDP - tests of tensile strength - determination of alkaline phosphatase, 14:32209 (R;DE;In German)
Sailor, W.C., *See* Byrd, R.C., 14:31824
Sakai, A., *See* Asano, H., 14:30517
Sakamoto, S., *See* Park, I. H., 14:32570
Sakashita, H., *See* Ishiwatari, M., 14:30386
Sal'nikov, O.A., Spectra of inelastically scattered neutrons with an initial energy of 14.1 MeV and nuclear level density, 14:32646 (R;XA)
Salamon, P., Wetted solid - a generalization of Plateau's problem and its implications for sintered materials, 14:31325 (R;DK)
Salgado, J., Some uses of radioisotope techniques in Portugal, 14:30647 (RA;BR)
Salgueiro, L., *See* Ferreira, J.G., 14:32497
Salicru, B., *See* Lamarque, J.L., 14:32293
Salmeron, M., *See* Marchon, B., 14:31376
Saloman, E. B., Energy levels and transition probabilities in the ground-state configuration of sulfur-like ions, 14:32514 (J;US)
Salzbrenner, R., Dynamic fracture toughness measurements of ferritic ductile cast iron, 14:31604 (R;US)
Samain, A., *See* Ghendrih, P., 14:32860
See Grosman, A., 14:32861
Samara, G. A., Breathing-mode lattice relaxation accompanying emission and capture by deep electronic levels in silicon, 14:31365 (J;US)
Pressure dependence of deep electronic levels in semiconductors: Phosphorus-vacancy pair (or Si *E* center) and divacancy in silicon, 14:31373 (J;US)
Samara, G.A., *See* Vook, F.L., 14:31228
Samarasekera, I., *See* Schvezov, C.E., 14:31282
Samis, M., *See* Macken, J., 14:31649
Sammon, P. H., *See* Bramble, J. H., 14:33016
Sampson, J.R., Characterization of two RNA-catalyzed RNA cleavage reactions, 14:32103 (BA;US)
Sanada, E.K., *See* Vannucci, A., 14:32872
Sandall, O.C., *See* Al-Ghawas, H.A., 14:31423
Sandberg, E., *See* Olsson, O., 14:30609
Sandberg, O., *See* Wiklund, H., 14:31153
Sander, B., Multilayered gradient echo sequence in MRT of focal hepatic lesions, 14:32224 (RA;DD;In German)
See Bittner, R., 14:32284
See Schoerner, W., 14:32244
Sanders, L.N., Selection of materials for Savannah River Site Consolidated Incinerator Facility (CIF) offgas system, 14:30616 (R;US)
Sanders, R.W., *See* Zeisler, R., 14:31460
Sanders, S. J., *See* Beck, C., 14:32668
Sanders, T.L., A source term methodology for spent fuel cask containment evaluations, 14:31606 (R;US)
Alternatives for implementing burnup credit in the design and operation of spent fuel transport casks, 14:31605 (R;US)
Technical issues affecting the transport of dual purpose casks, 14:30580 (R;US)
See Brady, M.C., 14:30588
See Griesmeyer, J.M., 14:30595
See Rashid, Y.R., 14:30586
Sanders, W.A., *See* He, Y., 14:31585
Sanders, W.P., *See* Burton, W.A., 14:30802
Sandonato, G.M., *See* Ferreira, J.L., 14:32781
Sandoval, S.P., *See* Schultze, L.E., 14:31431
Sandqvist, I., *See* Jansson, Aa., 14:30675
Sandring, K.H., Contrast-to-noise rate in ECG-triggered fast-field echo sequence, 14:32281 (RA;DD;In German)
NMR imaging in carditis and cardiomyopathies, 14:32278 (RA;DD;In German)
See Luening, M., 14:32222
Sands, M., *See* Bambade, P., 14:31723
Sands, S.D., Liquefaction characteristics of Highvale coal in the Dow Coal Liquefaction Process, 14:30243 (R;CA)
Sanduleak, N., *See* Shore, S.N., 14:32453
Sanford, T. W. L., Measurement of electron energy deposition necessary to form an anode plasma in Ta, Ti, and C for coaxial bremsstrahlung diodes, 14:32888 (J;US)
Sanford, T.W.L., *See* Ramirez, J.J., 14:32930
Sanjurjo, A., *See* Dickinson, P. H., 14:31296
Sannes, F., *See* Park, I. H., 14:32570
Sano, T., *See* Ozeki, H., 14:32158
Santoro, R.T., Shield optimization program, Part I: Executive summary, 14:33028 (R;US)
Santoru, J., *See* Cheung, P. Y., 14:32480
Santos, C.A.C., *See* Oliveira, J.C.M. de, 14:31814
Santos, D.I. dos, SAXS study of silica sols, gels and glasses obtained by the sol gel process, 14:32748 (R;BR;In Portuguese)
Sapko, M.J., *See* Weiss, E.S., 14:30335
Sapp, W., *See* Beise, E. J., 14:32658
Saraeva, M.K., *See* Golubev, A.I., 14:32504
Sarantsev, V.P., *See* Golutvin, I.A., 14:31750
Sarbutt, J.V., *See* Lowson, R.T., 14:30620
Sardemann, G., *See* Braeutigam, K.R., 14:31928
Saritepe, S., *See* Michelotti, L., 14:31714
Sarker, C.R., *See* Cherdack, R.N., 14:32944
Sartori, R., *See* Mainardi, R.T., 14:32501
Sasaki, N., Advances in vitrification techniques in Japan, 14:30501 (RA;US)
Sass, S.L., Experimental studies of the structure of grain boundaries: Progress report, 14:31191 (R;US)
Sastry, D.L., Dependence of $K\beta/K\alpha$ ratio on the chemical constitution of the atom in Cr, Mn and Fe, 14:32498 (RA;BR)

Sathaye, J., An end-use approach to development of long-term energy demand scenarios for developing countries, 14:30996 (R;US)
Sato, S., *See* Enomoto, M., 14:30352
Sato, T., Some applications of rf-fields to plasmas, 14:32859 (RA;BR)
Satterfield, C.N., *See* Yatos, I.C., 14:30267
Satyanarayana, G., *See* Sastry, D.L., 14:32498
Sauerbrey, R., *See* Wisoff, P.J., 14:31641
Sauermann, P.F., Shielding of low-energy cyclotrons, 14:31700 (RA;AT;In German)
See Knieper, J., 14:31698
Saulys, A.C., MPS [Multiparticle Spectrometer] data acquisition software system, 14:31804 (R;US)
Sauter, R., *See* Bruhn, H., 14:32264
Sauty, J.P., *See* Iris, P., 14:30931
Sauvage, J., *See* Roussiere, B., 14:32669
Savage, M. J., SU(3) predictions for nonleptonic *B*-meson decays, 14:32627 (J;US)
Sawatzky, H., *See* Dymock, K.R., 14:30653
See Farnand, B.A., 14:31430
Sawicki, R.H., Continuously deformable mirrors, 14:30642 (BA;US)
Sawyer, S., Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)
Scaggs, K.R., *See* Perry, R.E., 14:30536
Scandrett, C., Comparison of several iterative techniques in the solution of symmetric banded equations on a two-pipe Cyber 205. Technical report, 1 October 1987-30 September 1988, 14:32975 (R;US)
Scanlan, R., *See* Gilbert, W.S., 14:31765
Scanlan, R.M., Development of superconducting strand and cable with improved properties for use in SSC [Superconducting Super Collider] magnets, 14:31763 (R;US)
Scarf, F.L., *See* Gurnett, D.A., 14:32442
Scaria, P.M., *See* Ramaiah, D., 14:31555
Schaad, M.W., *See* Briggs, D., 14:31853
Schaefer, H.F. III, *See* Yates, B.F., 14:31534
Schaetzle, W.J., *See* Brett, C.E., 14:30938
Schaffartzik, W., Prospective study on the behaviour of values obtained by organ function studies, in particular scintiscan studies of pulmonary perfusion, during treatment of little to moderately advanced tuberculosis, shown by X-rays to involve one lobe of the lung, 14:32347 (R;DE;In German)
Schaich, C.R., *See* Langley, R.A., 14:32899
Schanwald, L.P., *See* Denison, G.J., 14:32931
See Zutavern, F.J., 14:31672
Schaphorst, S. J., *See* Sorensen, S. L., 14:32528
Schapira, J.P., *See* Fortier, S., 14:32664
Schatzinger, R., *See* Honarpour, M., 14:30293
Scheffler, K., Design experience of PAMELA, 14:30500 (RA;US)
Scheibler, C., *See* Zur, C., 14:32242
Scheiner, S., Effects of external ions upon proton transfer reactions: H-bonded systems containing HCOOH, 14:32188 (BA;US)
Scheinman, A., *See* Oakes, M., 14:32147
Schelbert, H.R., *See* Grover, M., 14:32354
Schell, D., *See* Brennan, A., 14:30657
Schenk, R., Investigations of hydrogen generation by iron corrosion under repository conditions, 14:31217 (R;CH;In German)
Schenk, W., Fission product release profiles from spherical HTR fuel elements at accident temperatures, 14:30906 (R;DE)
Scherson, D.A., *See* Fierro, C., 14:31540
Schettler, T., *See* Hofmann, P.J., 14:30839
Schickerova, R., *See* Kalvach, P., 14:32332
Schiferl, D., *See* Engelke, R., 14:31539
Schildkraut, I., *See* Xia, Y., 14:32200
Schillaci, M. E., *See* Heffner, R. H., 14:31252
Schiltz, D.C., Preliminary assessment of an inflatable inspection probe: Phases 1 and 2, 14:30866 (R;US)
Schipper, L., *See* Sathaye, J., 14:30996
Schlag, E.W., *See* Lin, S.H., 14:31517
Schlegel, E., *See* Cramer, B.M., 14:32294
Schleisner Ibsen, L., Low-temperature heat storage at Risoe. Pilot project, 14:30960 (R;DK;In Danish)
Schlenker, R.A., *See* Huberman, E., 14:32371
Schloss, J.H., *See* McCown, A.W., 14:31646
Schmidt, D., Theoretical evaluation and experimental results of parameter weighting in NMR imaging, 14:32230 (RA;DD)
See Juran, R., 14:32231
Schmidt, G., *See* Hieckel, H.G., 14:32286
Schmidt, H.K., *See* Gill, J.T., 14:32954
Schmidt, H.R., *See* Albrecht, R., 14:32706
Schmidt, K. E., *See* Maltman, K., 14:32599
Schmidt, M., *See* Hieckel, H.G., 14:32286
Schmidt, R., *See* Pack, R., 14:30876
Schmidt, W., *See* Wandl-Hainberger, I., 14:32352
Schmidt-Peter, P., *See* Markwardt, J., 14:32315
See Rotte, K.H., 14:32319
See Stuerzer, I., 14:32314
Schmier, W., *See* Kunkel, R., 14:31843
Schmitt, A.M., Validity and reliability of results of epidemiological studies for the estimation of the radiation included lung cancer risk, 14:32380 (RA;AT)
Schmitt, R.C., *See* Cha, Y.S., 14:30877
See Reno, H.W., 14:30898
Schmitz, H., Current situation with respect to oil shale research and the use of oil shale in the Federal Republic of Germany, 14:30325 (RA;CN)
Schmitz, J., Practical experience with dose measurements in uranium mines, 14:31828 (RA;AT;In German)
Schmitz, T., Investigation on the performance of a TEPC dose-equivalent meter for area monitoring, 14:31845 (RA;AT)
Schnackenburg, B., *See* Dewey, C., 14:32276
See Juran, R., 14:32231
See Schmidt, D., 14:32230
Schneider, A., *See* Levin, A.E., 14:30875
Schneider, G., *See* Braenden, C.I., 14:32126
Schneider, K.J., *See* Ross, W.A., 14:30473
Schneider, W., Optimization of pulse sequence and parameters in NMR imaging to improve the contrast-to-noise ratio by nonlinear optimization, 14:32262 (RA;DD;In German)
Schneider, W.R., *See* Schiltz, D.C., 14:30866
Schnetzer, S., *See* Park, I. H., 14:32570
Schock, R. N., Electrical conduction in olivine, 14:32437 (J;US)
Schoen, M., *See* Jochem, E., 14:30806
Schoenhofer, F., *See* Henrich, E., 14:32011, 14:32017
Schoenrock, J., *See* Beck, S.R., 14:30664
Schoepke, W., *See* Luening, M., 14:32222
Schoerner, W., Native and contrast medium NMR imaging of meningeal diseases, 14:32244 (RA;DD;In German)
See Henkes, H., 14:32336
See Hosten, N., 14:32257
Scholz, A., Detector system for two-dimensional, position-sensitive detection of neutrons and gamma quanta, 14:31816 (R;DE;In German)
Scholz, D., *See* Dewey, C., 14:32276, 14:32292
See Gruender, W., 14:32271
Scholz, H., Method for the retrospective determination of contamination from the Chernobyl accident. Gamma spectroscopic evaluation of woodpiles, 14:32018 (RA;AT;In German)
Schone, H., *See* Schulz, M., 14:32516
Schrire, D., The Studsvik Super-Ramp Extension Project: Ceramography of Asea Atom test fuel rod OL1-1, 14:30832 (R;SE)
Schrock, S.L., *See* Peishel, F.L., 14:31590
Schroeder, G., *See* Cobet, H., 14:32287
Schroeder, H.A., *See* Dale, B.E., 14:30730
Schueckler, M., *See* Dierkes, L., 14:30918
Schuetz, H.J., What kind of advantages offers MRT compared with CT in imaging spontaneous intracerebral hematomas, 14:32331 (RA;DD;In German)
Schuetz, M., Investigations on radon exhalation rates of the soil, 14:32010 (RA;AT;In German)
Schuetz, P., Fuel cells for use in the field of transportation. American initiatives, 14:31044 (R;DK;In Danish)
Schuhmacher, H., *See* Menzel, H.G., 14:31842
Schuhmann, G., *See* Schulz, H., 14:30264

Schuler, A., *See* Braeutigam, K.R., 14:31928
Schuler, R.H., *See* Tripathi, G.N.R., 14:31513
Schuller, I. K., *See* Locquet, J., 14:31263
Schultz, J.A., *See* Gill, J.T., 14:32954
Schultz, P.G., *See* Pollack, S.J., 14:32089
Schultze, L.E., Supported liquid membrane separation of aluminum from copper leaching liquors, 14:31431 (J;US)
Schulz, G.E., Structural and functional relationships in the adenylate kinase family, 14:32121 (BA;US)
Schulz, H., Characterisation of novel matrix catalysts and catalyst selectivity control for alpha olefin synthesis on the basis of CO and H/sub 2/, 14:30264 (R;DE;In German)
Schulz, M., Electron-electron interactions in transfer and excitation in $F^{8+} \rightarrow H_2$ collisions, 14:32516 (J;US)
Schulz, V., *See* Braeutigam, K.R., 14:31928
Schulz, W., Indication and accuracy of CT-aided biopsy of the brain, 14:32240 (RA;DD;In German)
See Harms, L., 14:32301
Schulz, W.W., TRUEX process and the management of liquid TRU waste, 14:30619 (J;US)
Schulze, J., Measuring time-dependent neutron flux from 14MeV neutron generators by radioactivation techniques, 14:31846 (RA;AT;In German)
Schuraytz, B. C., Evidence for dynamic withdrawal from a layered magma body: The Topopah Spring Tuff, southwestern Nevada, 14:32426 (J;US)
Schuster, H., *See* Funke, T., 14:31214
Schvezov, C.E., Factors affecting stress distribution and displacements in crystals III-V grown by Czochralski method with liquid encapsulation, 14:31282 (R;BR;In Spanish)
Schwartz, A.W., In search of RNA ancestors, 14:32082 (BA;US)
Schwarz, E.R., Radiation exposure of the population in Federal Republic of Germany from X-ray diagnosis. Trends and alternative diagnostic methods, 14:32350 (RA;AT;In German)
Schwarzkopf, T., Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)
Schwarzkopf, W., *See* Smailos, E., 14:30566
Schweppe, F.C., *See* Caramanis, M.C., 14:31035
Sciani, V., *See* Lucki, G., 14:31213
Scicluna, E., *See* Zaidi, A., 14:31682
Scoditti, E., *See* Canonico, A., 14:30490
Scofield, P., Radon decay product in-door behavior - parameter, measurement method, and model review, 14:31856 (R;SE)
Scolfaro, L.M.R., Charge state stability of interstitial impurities in gallium arsenide, 14:32791 (RA;BR)
Scott, A. C., Polarons in acetanilide, 14:31375 (J;US)
Scott, B.R., Models for pulmonary lethality and morbidity after irradiation from internal and external sources, 14:30909 (R;US)
See Filipy, R.E., 14:32376
Scott, C.B., *See* Collins, E.D., 14:30459
Scott, C.D., Coal solubilization by enhanced enzyme activity in organic solvents, 14:30247 (R;US)
Scott, D., *See* Achari, A., 14:32122
Scott, H.L., Gamma-ray emission probabilities of the daughters of ^{238}U, 14:32692 (R;US)
Scott, J.J., *See* VanHooren, D.L., 14:31118
Scott, J.L., *See* Gurley, R.N., 14:30499
Scott, M., *See* Edmonds, J., 14:31920
See Ensley, E.K., 14:30392
Scott, R. B., *See* Broxton, D. E., 14:32427
Scott, T.C., An electrically driven multistage countercurrent solvent extraction device, 14:30297 (J;US)
Droplet size characteristics and energy input requirements of emulsions formed using high-intensity-pulsed electric fields, 14:31489 (J;US)
Use of high-gradient magnetic fields for the separation of macromolecules, 14:31424 (J;US)
Scott-Walton, B.L., *See* Witwer, C.R., 14:32405
Scwabe, W.K., *See* Mendes, C.M., 14:31389
Seabrook, P.T., Development of cementitious grouts for post-tensioned concrete members use in offshore structures and in the arctic environment. Vol. 3, Evaluation of pulse-echo technology for detection of voids in grouted ducts, 14:31664 (R;CA)
Sedillo, E., *See* Huang, J.S., 14:31240
Seely, J. F., Transmission filter for the extreme ultraviolet spectral region composed of a thin Saran ($C_2H_2Cl_2$) foil, 14:31887 (J;US)
Seem, J. E., Comprehensive room transfer functions for efficient calculation of the transient heat transfer processes in buildings, 14:31095 (J;US)
Seeman, J.T., *See* Adolphsen, C.E., 14:31776
Sefzick, T., Fast trigger scintillator for the JETSET experiment (PS202/LEAR), 14:31817 (R;DE;In German)
Seibel, R.M., CT-controlled lumbar sympathectomy in treatment of occlusive arterial disease, 14:32304 (RA;DD;In German)
Seibert, A.F., Performance of spray, sieve tray, and packed contactors for high pressure extraction, 14:31453 (J;US)
Seiler, S.R., *See* Sharp, P.A., 14:32104
Seitter, W.C., *See* Bode, M.F., 14:32447
Seligman, P.J., *See* Zaebst, D.D., 14:31956
Semler, B.L., *See* Kuhn, R.J., 14:32197
Sen'kov, P.E., *See* Lapenas, A.A., 14:32649
Senapati, N., *See* Muralidhara, H.S., 14:31455
Sengupta, A., Separation of liquid solutions by contained liquid membranes, 14:31434 (J;US)
Senseny, P.E., *See* Munson, D.E., 14:30582
Sepaniak, M.J., *See* Balchunas, A.T., 14:31443
Sequeira, L., *See* Lewosz, J., 14:30704
Seregina, E.A., *See* Dyachenko, P.P., 14:32689
Service, R.R., Electrical parameters of large turbo-generators, 14:30796 (R;CA)
Seshadri, K.S., *See* Shadle, L.J., 14:30347
Sessler, A.M., *See* Hopkins, D.B., 14:31697
See Whittum, D.H., 14:31722
Sette, F., Crystal-field splitting of core excitons in ionic crystals, 14:31367 (J;US)
Seubert, L., *See* Rowe, M.S., 14:30986
Sexton, K.G., *See* Jeffries, H.E., 14:31939, 14:31940, 14:31941, 14:31942
Sha, W.T., *See* Cha, Y.S., 14:30877
Shaanan, B., *See* Perutz, M.F., 14:32133
Shadle, L.J., Characterization of flash pyrolysis products from Green River shale, 14:30347 (RA;CN)
Shaffer, R.J., *See* Blair, S.C., 14:32435
Shalroth, S. M., *See* Schulz, M., 14:32516
Shah, K.R., *See* Gurley, R.N., 14:30499
Shah, P.A., *See* Kamperschroer, J.H., 14:32928
Shah, V.L., *See* Cha, Y.S., 14:30877
Shakkottai, P., *See* Venkateshan, S. P., 14:31684
Shamkhani, H., *See* Bennett, P.C., 14:31610
Shamovskij, V.G., Ion source with increased service life, 14:31748 (R;SU;In Russian)
Shankland, T. J., *See* Schock, R. N., 14:32437
Shanklin, S.A., Evaluation of HCl continuous-emission monitors. Final report, May 1986-May 1987, 14:31949 (R;US)
Shankweiler, G., *See* Oakes, M., 14:32147
Shapiro, G., *See* Krug, R.M., 14:32111
Shapley, J.R., *See* Roginski, R.T., 14:31503
Sharma, B., *See* Honarpour, M., 14:30293
Sharma, D.N., *See* Achuthan, P.V., 14:31383
Sharma, R. P., Crystalline to amorphous transformation in GaAs during Kr ion bombardment: A study of elastic behavior, 14:31349 (J;US)
Sharma, R.D., Data base pertinent to earthquake design basis, 14:30878 (R;IN)
Sharma, V., *See* Bortoletto, D., 14:32573
Sharp, P.A., Splicing of messenger RNA precursors, 14:32104 (BA;US)
Sharp, P.M., *See* Li, W.H., 14:32162
Sharpe, S. R., The world according to lattice QCD, 14:32636 (J;US)
Shaw, R.W., Diode laser initiated resonance ionization mass spectrometry of lanthanum, 14:31408 (J;US)
Shay, T.M., Cesium laser-excited optical filter, 14:31643 (BA;US)
Shchegiov, M.A., *See* Voropaev, S.G., 14:32874
Shegelski, M. R. A., Numerical simulations of hopping conductivity using nonflat densities of states, 14:32814 (J;US)

Sheldon, C.C., *See* Forster, A.C., 14:32101
Shelton, R. N., *See* Radousky, H. B., 14:31312
Shen Minzi, Application of oxygen and hydrogen isotopes of waters in Tengchong hydrothermal systems of China, 14:32056 (RA;XA)
Shen, D., *See* Lu, S., 14:30385
Shen, G.-J., Research on energy storage in the underground water and its quality in Changzhou city, 14:30955 (RA;CA;In English and French)
Shen, M., *See* Shadle, L.J., 14:30347
Shen, Y. R., *See* Zhu, X. D., 14:32805
Shepard, K.W., *See* Bogaty, J.M., 14:31692
Shepard, T.D., *See* Langley, R.A., 14:32899
Sheppard, J.M., Endangered Species Listing Handbook: handbook to preparing and processing actions to list, delist, or reclassify endangered or threatened species (third edition), 14:32076 (R;US)
Shera, E.B., Physics Division progress report, October 1, 1986–September 30, 1987, 14:33025 (R;US)
Sherby, O.D., *See* Whalen, R.T., 14:31241
Sheridan, T.J., *See* Ramirez, J.J., 14:32930
Sherman, R.H., Operation of the TSTA isotope separation system with 100 gram tritium, 14:32963 (J;US)
Shevel', V.N., *See* Koval', G.N., 14:32763
Shi Huixin, *See* Cai Zuhuang, 14:32054
Shi Lei, *See* Cheng Caie, 14:32070
Shi Weijun, *See* Li Xueli, 14:32068
Shi, Baolan, The study of neutralization of Po-218 ions by small ion recombination in O_2, Ar and N_2, 14:31061 (R;US)
Shi, D., Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)
Shi, G., Shale oil industry in Maoming, 14:30414 (RA;CN)
See Liang, G., 14:30415
Shi, J., *See* Liao, Z., 14:30374
Shiang, M., Optimization of cellulase productivity from Acidothermus cellulolyticus, 14:30725 (RA;US)
Shieh, C.K., *See* Lai, M.M.C., 14:32112
Shihomatsu, H.M., Evaluation of the mass spectrometric isotope dilution technique with the addition of two tracers (/sup 233/U and /sup 235/U) in the determination of the concentration and distribution of uranium in minerals, 14:31390 (R;BR;In Portuguese)
Trace uranium analysis by isotope dilution alpha and mass spectrometry and comparison with other techniques, 14:30428 (RA;BR)
Trace uranium analysis in geological sample by isotope dilution-alpha spectrometry and comparison with other techniques, 14:31391 (R;BR;In Portuguese)
Shikuma, R., Corporate considerations related to competition: reshaping the corporation from the inside out, 14:31027 (RA;US)
Shilov, V.V., *See* Ivanitskij, P.G., 14:32800
Shimada, T., Large-volume high-pressure CO/sub 2/ laser for ultrashort pulse amplification, 14:31650 (BA;US)
See Hayashi, M., 14:30364
Shinoda, N., *See* Hayashi, M., 14:30364
Shipsey, I. P. J., *See* Bortoletto, D., 14:32573
Shirey, L., *See* Seely, J. F., 14:31887
Shlyakhter, A.I., *See* Petrov, Yu.V., 14:32456
Shoemaker, K.R., C-peptide helix from ribonuclease A considered as an autonomous folding unit, 14:32116 (BA;US)
Shoemaker, S., *See* Barnett, C., 14:30727
Shoemaker, W., *See* Campbell, R.D., 14:30902
Shore, S.N., Galactic and LMC extreme emission line supergiants compared: IUE observations of the Henize - Carlson and Zoo star samples of massive supergiants, 14:32453 (RA;FR)
Shpak, D.L., *See* Androsenko, Kh.D., 14:32684
Shpunt, L.B., *See* Dushin, V.N., 14:31576
Shriner, D.S., Adequacy of forestry data in assessing the impact of ozone: A national perspective, 14:31921 (R;US)
Shub, D.A., Family of autocatalytic group I introns in bacteriophage T4, 14:32205 (BA;US)
Shudo, A., *See* Nakamura, K., 14:32858
Shugart, L.R., TNT metabolites in animal tissues: Quarterly technical progress report No. 2, January 1, 1989–March 31, 1989, 14:32398 (R;US)
Shumar, M.L., *See* Anderson, J.E., 14:30622
Shurshikov, E.N., *See* Ignatochkin, A.E., 14:32712
Sichta, P., *See* Kamperschroer, J.H., 14:32928
Sidorov, S.V., *See* Vertebnyj, V.P., 14:32691
Siebert, B.R.L., Calculated dose equivalent responses of albedo and track etch individual neutron dosemeters on the ICRU-phantom, 14:31835 (RA;AT)
Siedschlag, W.D., *See* Molsen, H.P., 14:32241
Siegel, R.W., *See* Melendres, C.A., 14:31271
Siegrist, K., Simple, high current LaB_6 cathode, 14:32937 (J;US)
Siekhaus, W., *See* Marchon, B., 14:31376
Siekhaus, W.J., *See* Olander, D.R., 14:31347
Siemiarczuk, T., *See* Albrecht, R., 14:32706
Sienkiewicz, C.J., Physical inventory by use of modeling for the tritium aqueous waste recovery system, 14:32952 (J;US)
Sievers, R. E., *See* Dickinson, P. H., 14:31296
Sigler, P.B., *See* Achari, A., 14:32122
Silapabunleng, K., *See* Vanichseni, S., 14:30400
Silva, J.G. da, *See* Assuncao Matos, H. de, 14:32216
Silva, T.C.V. da, Hydrogen induced surface effects on the mechanical properties of type 304 stainless steel, 14:31202 (R;BR)
See Barone, S.D., 14:31197
Silveira, I.L. da, *See* Mendes, C.M., 14:31389
Silver, R.N., *See* Sokol, P.E., 14:32506, 14:32835
Sima, O.A., Contributions to the study of environmental radioactivity, 14:32009 (R;RO;In Romanian)
Simbolotti, G., *See* Anzidei, L., 14:32910
See Franconi, E., 14:32913
Simmons, G.J., Prepositioned shared secret and/or shared control schemes, 14:33022 (R;US)
Simmons, L. M., Jr., *See* Bender, C. M., 14:32848
See Cline, J., 14:32639
Simon, C., *See* Luening, M., 14:32222
Simon, J., PACOM net assessment: Pakistani and Indian nuclear perceptions. Volume 1. Main report. Final report, 31 January-31 August 1983, 14:31170 (R;US)
Simonen, E.P., Radiation effects on time-dependent deformation: Creep and growth, 14:31224 (R;US)
Simons, J. W., Characterization of several ultraviolet–visible emission lines from a lead hollow-cathode lamp, 14:32515 (J;US)
Simpkins, J.E., *See* Langley, R.A., 14:32899
Simpson, R.J., *See* Skedzielewski, S.K., 14:33012
Sims, C.S., *See* Swaja, R.E., 14:31848
Sims, T.R., *See* Garrett, D.L., 14:30747, 14:30748
Simulik, V.M., *See* Krivskij, I.Yu., 14:32633
Sinclair, G., *See* Lowson, R.T., 14:30620
Singh, B., *See* Ghumman, B.S., 14:32496
Singh, G., *See* Ghumman, B.S., 14:32496
Singh, N., *See* Singh, S., 14:32494
Singh, R.K., Some studies on fluid structure interaction problems, 14:31653 (R;IN)
Singh, S., M-shell x-ray fluorescence cross section measurements for some elements with $72 \leq Z \leq 92$ at 5.96 KeV, 14:32494 (RA;BR)
Sinha, S. K., *See* Garoff, S., 14:31549
Sinitskij, S.L., *See* Astrelin, V.T., 14:31717
Sinkovic, B., *See* Sette, F., 14:31367
Sinor, J.E., Industrial market assessment of the products of mild gasification: Final report, 14:30251 (R;US)
Potential production of specialty chemicals from oil shale in the United States, 14:30412 (RA;CN)
Sippach, W., *See* Hartouni, E. P., 14:32561
Sirkar, K.K., *See* Sengupta, A., 14:31434
Sirota, E. B., *See* Garoff, S., 14:31549
Sirotkin, K., *See* Lapedes, A., 14:32174
Sissingh, R.A.P., TFTR tritium program, 14:32945 (J;US)
See Gruetzmacher, K.M., 14:32940
Sisson, W.G., *See* Byers, C.H., 14:31449
See Scott, T.C., 14:31489
Sitenko, Yu.A., Electron in an external magnetic field: boundary conditions, anomaly and index, 14:32630 (R;SU;In Russian)
Sivasundaram, V., Fly ash in concrete. Compilation of abstracts of papers from recent international conferences and symposia on fly ash in concrete, 14:31111 (R;CA)
Skedzielewski, S.K., A simple method to remove reference counting in applicative programs, 14:33012 (R;US)
Skerra, A., *See* Plueckthun, A., 14:32090

Skiffington, B., *See* Gartrell, C.F., 14:31891
Skinner, F.D., Strategy for developing environmental sampling and analysis programs at coal-gasification pilot and demonstration plants. Topical report, 14:30266 (R;US)
Skofronick, J. G., *See* Chern, G., 14:31374
Skordas, E., *See* Kim, W.Y., 14:32421
Skov, E., Internal combustion engines. Effect, and diagrammatic calculations, 14:31158 (R;DK;In Danish)
Skriba, M.C., *See* Smeltzer, E.E., 14:30466
Skwarnicki, T., *See* Bortoletto, D., 14:32573
Slagle, O.D., Fabrication of lithium ceramic pellets, rings and single crystals for irradiation in BEATRIX-II, 14:32927 (R;US)
Slanetz, H., *See* Tschirf, E., 14:30891
Slaughter, M. D., Radiative meson decays—an algebraic approach, 14:32601 (J;US)
Sletting, S., *See* Hegedues, V., 14:32227
Slightom, J.L., *See* Goodman, M., 14:32166
Smailos, E., Gamma irradiation and in-situ corrosion studies on unalloyed steels for a high level waste packaging in a rock salt repository, 14:30566 (R;DE)
Small, G.J., *See* Cooper, R.S., 14:31458
See Zamzow, D., 14:32402
Smeltzer, E.E., Physical stability of cement encapsulated low level radwastes, 14:30466 (RA;US)
Smetannikov, V.V., *See* Solodukhin, V.P., 14:30379
Smilgys, R.V., *See* Johnson, A.W., 14:31289
Smirenkin, G.N., *See* Svirin, M.I., 14:32727
Smit, J., *See* Tabak, H.F., 14:32097
Smit, T., *See* Schmitz, T., 14:31845
Smith, B. W., *See* Glick, M. R., 14:31883
Smith, C., *See* Brown, K.W., 14:31999
See Codrington, J.B., 14:30927
Smith, D.H., *See* Shaw, R.W., 14:31408
Smith, F.G., *See* Plantz, M.R., 14:31400
Smith, F.W., *See* Sommer, M., 14:31318
Smith, G.C., *See* Debbe, R., 14:31803
Smith, G.M., *See* Yu, L.P., 14:32356
Smith, H., *See* Somers, B.R., 14:31190
Smith, J. L., *See* Heffner, R. H., 14:31252
Smith, J.A., Fiber optic sensing for NDE and process control, 14:31110 (R;US)
Smith, J.E., *See* Friedman, A.A., 14:30651
Smith, J.J., International bulletin on atomic and molecular data for fusion. No. 38, 14:32873 (R;XA)
Smith, K.M., *See* Barkigia, K.M., 14:32185
Smith, L., *See* Judd, D.L., 14:32924
Smith, L.L., *See* Li, K.Y., 14:31488
Smith, M.S., Shield optimization program: Part 5, A hydrodynamic comparison using HULL and PUFF-TFT for a one-dimensional aluminum slab, 14:33029 (R;US)
Smith, N.K., *See* Steele, W.V., 14:30311, 14:30313
Smith, R., *See* Hebbard, D.F., 14:32695
Smith, R.D., Reverse micelle supercritical fluid separations, 14:31452 (J;US)
See Udseth, H.R., 14:31403
Smith, R.E., Iodine emission from separations processes and flowsheets for improved emission control, 14:30562 (R;US)
Smith, R.I., *See* Ross, W.A., 14:30473
Smith, R.J., *See* Fifield, L.K., 14:32662
Smith, T.F., *See* Jurka, J., 14:32118
Smith, W. W., *See* Tang, C. Y., 14:32525
Smith, W.K., *See* Rabideau, P.W., 14:31484
Smith, W.W., *See* Eisenberg, D., 14:32125
Smolen, G.R., *See* Lloyd, R.C., 14:30440
Smolyakov, N.V., Electromagnetic radiation shaping in a plane undulator with groved pole surface, 14:31716 (R;SU;In Russian)
Smuin, M.W., *See* Crutcher, J.W., 14:32022
Smyrl, H. R., *See* Hembree, D. M., Jr., 14:31882
Sneddon, S.F., Influence of geometrical fluctuations on electron tunneling barriers in proteins, 14:32179 (BA;US)
Snigirev, A.M., *See* Goloviznin, V.V., 14:32587
Snijders, A.L., The feasibility of seasonal storage of excess heat for the district heating system at Almere, 14:30954 (RA;CA;In English and French)
See van der Bruggen, R.J.A., 14:30950
Snow, R.H., *See* McEntire, B.J., 14:31291
Snow, W.M., *See* Sokol, P.E., 14:32506
Sobolik, K.B., *See* Keltner, N.R., 14:30601
Soe, L.H., *See* Lai, M.M.C., 14:32112
Soereide, I., Procedures for reservoir fluid characterization using an equation of state model. Application to fluids in the Danish North Sea, 14:30393 (R;DK)
Soerensen, C.B., *See* Lindelof, P.E., 14:31330
Soerensen, J.D., Probabilistic design of offshore structural systems, 14:31686 (R;DK)
Sofronov, I.D., Methods and programs for numerical solution of the mathematical physics problems. Scientific-technical collection, 14:32824 (R;SU;In Russian)
Sokcic-Kostic, M., *See* Antic, D., 14:30916
Sokiranski, R., *See* Felsenberg, D., 14:32236
Sokol, P.E., Final state effects in liquid ^{4}He: An experimental test, 14:32506 (R;US)
Momentum distributions: An overview, 14:32835 (R;US)
Sokolov, A.M., Approximation of experimental dependences by two-support method, 14:33000 (R;SU;In Russian)
Sokolov, J., *See* Wu, S. C., 14:31260
Sokolov, V.V., *See* Zelevinckij, V.G., 14:32724
Soliani Junior, E., *See* Poupeau, G., 14:32412
Sollins, P., *See* Van Miegroet, H., 14:30701
Solodukhin, V.P., Neutron activation analysis possibilities for the elemental composition research in oil-shales, oil-bituminous rocks, petroleum and their fractions, 14:30379 (RA;CN)
Solomon, J.M., *See* Bell, J.B., 14:32529
Soltau, H., *See* Borchardt, D., 14:30893
Soltau, R.L., Roadway lighting equipment management systems. Preliminary review: final report synopsis. [B] User standards for luminaire specifications, vol. 1, 14:31140 (R;CA)
Soltes, E.J., Cell wall mechanisms of resistance to enzymatic hydrolysis, 14:30729 (RA;US)
Somers, B.R., Effects of auxiliary heat treatments on flame-cutting procedures, 14:31190 (R;US)
Sommer, L., *See* Sandring, K.H., 14:32281
Sommer, M., Thermodynamics and high temperature chemistry of the chemical vapor deposition of diamond films, 14:31318 (R;US)
Somorjai, G.A., *See* Marchon, B., 14:31523
Sondhaus, C.A., Alternatives to dose, quality factor and dose equivalent for low level irradiation, 14:32367 (R;US)
Song-Hak Cho., Attempts at modelling the processes of gas- and water-atomization for the production of metal powders, 14:31198 (R;DE;In German)
Sorensen, N.R., *See* Christensen, T.M., 14:31666
Sorensen, S. L., Coster-Kronig yields in silver measured with synchrotron radiation, 14:32528 (J;US)
Sorensen, S.N., Groundwater heat pumps in combination with low-temperature natural heat sources. Economical and technical aspects, 14:30953 (RA;CA;In English and French)
Sorenson, K.B., *See* Salzbrenner, R., 14:31604
Sorenson, S.C., *See* Skov, E., 14:31158
Sosnick, T.R., *See* Sokol, P.E., 14:32506
Souchet, Y., *See* Evrard, J.M., 14:30863
Souers, P.C., *See* Failor, R.A., 14:32962
See Wilson, S.W., 14:31624
Soufer, D., *See* Oakes, M., 14:32147
Souissi, M., *See* Moreau, J.F., 14:32274
Sourdis, J., *See* Li, W.H., 14:32162
Sourirajan, S., *See* Lui, A., 14:31441
Souza Dutra, A. de, Transport coefficients for laminar and turbulent flow through a four-cusp channel, 14:31655 (R;BR)
Souza Mendes, P.R. de., *See* Souza Dutra, A. de, 14:31655
Souza, A.D.B. de, *See* Oliveira, J.C.M. de, 14:31814
Souza, A.L. de., *See* Cunha Menezes Filho, A. da, 14:30860
Souza, C.A.W., *See* Jayanthi, U.B., 14:31798
See Villela, T., 14:31797
Spanier, L., Study of beta decay energies and atomic masses, 14:32673 (R;SE)
Sparks, C. J., *See* Kan, X. B., 14:31363
Spear, R.H., *See* Fewell, M.P., 14:32677
See Lim, C.S., 14:32679

Spencer, C.W., *See* Krupa, M.P., 14:30314
Spencer, F.W., *See* Easterling, R.G., 14:33009
Spencer, J., Magnets for high energy colliders, 14:31770 (R;US)
Spencer, J.E., Accelerator diagnosis and control by Neural Nets, 14:31703 (R;US)
Spencer, T., Overproduction of xylose isomerase and control of xy1A copy number in large-scale fermentations of Escherichia coli, 14:30732 (RA;US)
Sperling, R.B., Learning the value of VE, 14:32973 (R;US)
Sperry, D., *See* Noble, R.D., 14:31426
Spielmann, M., *See* Vanel, D., 14:32329
Spielmann, R.P., NMR imaging of thoracic aortic dissection, 14:32280 (RA;DD;In German)
Spindler, D.D., Simultaneous saccharification and fermentation of cellulose and wheat straw to ethanol: evaluation of thermotolerant yeast and B-glucosidase supplementation, 14:30667 (RA;US)
Spinka, H., *See* Auer, I. P., 14:32575
Spiro, P.S., *See* Parker, J.C., 14:30974
See Tharp, W.H., 14:30973
Spiro, T.G., *See* Czernuszewicz, R.S., 14:31499
See Su, Y.O., 14:31498
Spitler, M.T., Photoelectrochemistry and photochemistry of sensitized semiconductor surfaces, 14:31293 (BA;US)
Spontarelli, T., *See* Koval, C.A., 14:30268
Sprecher, A.F., *See* Cao, W., 14:31176
Springsten, S.R., *See* Roberts, J.M., 14:31411
Squillante, M.R., *See* McCann, W.J., 14:32956
Squyres, S.W., *See* Arnold, J.R., 14:32458
Srdoc, D., *See* Obelic, B., 14:30884
Sreekrishna Murty, G., *See* Sastry, D.L., 14:32498
Sresty, G., *See* Dev, H., 14:31998
Sridhar, T.S., High-level liquid waste treatment: process development studies in the WIPE facility, 14:30503 (RA;US)
Srinivasan, S., Fuel cells for extraterrestrial and terrestrial applications, 14:31053 (J;US)
Srinivasan, T.G., Effect of uranium on third phase formation in the Pu(IV)-HNO_3-TBP-dodecane system, 14:30445 (J;US)
See Nayak, S.K., 14:30447
Srp, A., Computed tomography of splenic trauma, 14:32255 (RA;DD)
St. Angelo, C., *See* Krug, R.M., 14:32111
Stackhouse, T., Role of protein folding in the evolution of protein sequences, 14:32131 (BA;US)
Stadlmueller, J., *See* Plueckthun, A., 14:32090
Stafford, B. L., *See* Langford, A. A., 14:31679
Stahl, D., *See* Nelson, T., 14:30610
Stallard, B.W., ECH on the MTX [Microwave Tokamak Experiment], 14:32886 (R;US)
Stamatovic, M., *See* Bae, J.H., 14:31421
Standertskjoeld-Nordenst, *See* Rosenkranz, G., 14:32759
Stanev, T., *See* Barr, G., 14:32471
Stangenberg, F., *See* Chouw, N., 14:30922
Stangl, C., *See* Parkash, S., 14:30269
Stanley, H. B., *See* Garoff, S., 14:31549
Stannett, V.T., Radiation-induced polymerization of cyclophosphazene trimers. Final report, 1 September 1985-30 September 1988, 14:31568 (R;US)
Staples, B.A., *See* Baker, R.S., 14:30516
Staricheskaya, E.V., *See* Koval', G.N., 14:32763
Stark, D.D., Differential diagnosis of focal hepatic lesions by MR, 14:32223 (RA;DD)
MRI contrast agents, 14:32273 (RA;DD)
Starmer, R.J., *See* Johnson, T.C., 14:30633
Starr, T.M., *See* DaCosta, D.H., 14:30488
Stasch, W., *See* Loeschhorn, U., 14:30897
Stasiulevicius, R., *See* Tofani, P.C., 14:30890
Staudhammer, K.P., *See* Johnson, K.A., 14:31297
Stauffer, F.J., *See* Arunasalam, V., 14:32881
Staun Olsen, J., Bulk moduli and high pressure phases of the uranium rocksalt structure compounds. Pt. 2. The monopnictides, 14:31327 (R;DK)
Bulk moduli and high pressure phases of ThX compounds. Pt. 2. The thorium monochalcogenides, 14:31329 (R;DK)
See Gerward, L., 14:31326, 14:31328
Stebbins-Boaz, B., *See* Gerbi, S.A., 14:32150
Steele, K.F., *See* Turner, R.R., 14:32005
Steele, W.V., Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)
High-temperature heat-capacity measurements and critical property determinations using a Differential Scanning Calorimeter: Results of measurements on toluene, tetralin, and JP-10, 14:30313 (R;US)
Steffen, H., *See* Zur, C., 14:32242
Steger, F., *See* Mueck, K., 14:32015
Stein-Schabes, J. A., *See* Maeda, K., 14:32467
Steinberg, D.J., Comparison of experimental shock-wave profiles for tungsten and computer simulations using a rate-dependent constitutive model, 14:32802 (R;US)
Steinhaeusler, F., *See* Reubel, B., 14:32379
See Rockwood, L., 14:30911
Steinsberger, S.C., *See* Shanklin, S.A., 14:31949
Stelling, J.S., *See* Davis, D.S., 14:31945
Stenberg, D.R., *See* Madsen, M.M., 14:30592
Stencel, J.R., *See* Griesbach, O.A., 14:32961
See Gruetzmacher, K.M., 14:32940
Stencil, J.R., TFTR health physics tritium measurements following D-D operations, 14:32953 (J;US)
Stenhova, H., *See* Roithova, Z., 14:32305
Stenke, L., *See* Olsson, S.E., 14:30925
Stephan, G., *See* Wittler, C., 14:32387
Stephani, D., *See* Debbe, R., 14:31803
Stephenson, D.E., *See* Zoback, M.D., 14:32429
Stephenson, G. J., Jr., *See* Maltman, K., 14:32599
Stephenson, L.C., Upgrading Julia Creek shale oil - syncrude or fully refined products, 14:30363 (RA;CN)
Stermer, D.L., *See* Berglund, G.R., 14:30540
Stern, M.K., *See* Czernuszewicz, R.S., 14:31499
Stern, S., *See* Holler, H.F., 14:32149
Sternbach, E.J., *See* Hopkins, D.B., 14:31697
Steube, D., *See* Assmann, H., 14:32307
Stevens, D.C., *See* Parker, R.C., 14:31587
Stevens, R.C., *See* Yuan, H.S.H., 14:32355
Stewart, C.B., Sequence convergence and functional adaptation of stomach lysozymes from foregut fermenters, 14:32167 (BA;US)
Stewart, D. S., *See* Bdzil, J. B., 14:32533
Stewart, J., *See* Dixon, R., 14:30277
Stewart, J. E., *See* Tang, C. Y., 14:32525
Stewart, J.M., *See* Shoemaker, K.R., 14:32116
Stieff, L.R., *See* Kotrappa, P., 14:31064
Stiger, S.G., Well testing and reservoir evaluation, 14:30769 (RA;US)
Stigers, R.A., Iowa Electric's addition of a low level radwaste processing and storage facility to the Duane Arnold Energy Center, 14:30548 (RA;US)
Stiller, D., NMR spectroscopy of the perfused rat liver: technical considerations, 14:32270 (RA;DD;In German)
See Gewiese, B., 14:32269
Stock, L.M., *See* Zabransky, R.F., 14:30265
Stockhausen, W., *See* Mir, R., 14:31852
Stockman, L., *See* Locquet, J., 14:31263
Stoeffl, W., *See* Roy, N., 14:32682
Stoelzel, D.M., An experimental study to determine the relative influence of fluid-fluid interactions and media heterogeneities on the growth of immiscible viscous fingers, 14:30289 (R;US)
Stoffel, T.L., *See* Emery, K.A., 14:30738
Stogner, J.M., *See* Gangwal, S.K., 14:30250
Stoica, S., Study of spectroscopical properties of intermediate and heavy nuclei, 14:32715 (R;RO;In Romanian)
Stokes, G., *See* Edmonds, J., 14:31920
Stone, G., *See* Bourgade, J.L., 14:31179
Stone, R., *See* Park, I. H., 14:32570
Stone, S.F., *See* Zeisler, R., 14:31460
Storch, S.N., *See* Godbee, H.W., 14:30474
Storm, C.B., *See* Engelke, R., 14:31539
Storm, J., Analysis of resonance oscillation of the neutron flow in a BWR-core, 14:30823 (R;SE;In Swedish)
Stormont, J.C., *See* Borns, D.J., 14:30579

Storton, J.M., *See* Jacob, N.P., 14:30457
Stoutland, P.O., C-H insertion and π-complex formation reactions of $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir$ with ethylene: an intra- and intermolecular isotope effect study, 14:31525 (J;US)
Strachan, N.R., Optimization of waste management by actions taken at source, 14:30560 (R;FR)
Strasbourg-1 Univ., 67, *See* Haas, F. 5Strasboug-1 Univ., 67, 14:32655
Stratman, M.P., *See* Huang, J.S., 14:31240
Straton, J. C., *See* McGuire, J. H., 14:32518
Straub, G.K., Thermodynamics of metallic solids and fluids from molecular dynamics, 14:31233 (BA;US)
Straub, W., *See* Chrostek, W.J., 14:31944
Straub, W.E., Health-hazard evaluation determination report No. 75-121-281, Penn Central Transportation Company, Philadelphia, Pennsylvania, 14:31946 (R;US)
Straubel, U., *See* Rockstroh, G., 14:32235
Streetman, K.D., Issues and approaches for electronic document approval and transmittal using digital signatures and text authentication, 14:32999 (R;US)
Streets, D.G., *See* Bando, A., 14:31918
Streit, G.E., *See* Rofer, C.K., 14:32036
See Tanner, R.L., 14:31978
Stroem, G., Quantification of micro organisms in biofuels - a quick analytical method, 14:31395 (R;SE;In Swedish)
Strommen, D.P., *See* Mallick, P.K., 14:31522
Strovink, M., Hermeticity of three cryogenic calorimeter geometries, 14:31811 (R;US)
Strube, M.M., *See* Steele, W.V., 14:30310
Struble, G. L., *See* Mann, L. G., 14:32676
Struble, G.L., *See* Roy, N., 14:32682
Struminskij, B.V., *See* Chikovani, Z.E., 14:32586
See Jenkovszky, L.L., 14:32588
Strunk, W.D., UF-6 cylinder overpack phenolic foam drop tests, 14:30448 (R;US)
Struve, W.S., *See* Causgrove, T.P., 14:31531, 14:31541
Stubbe, J., *See* Lin, A.I., 14:32137
Stuchbery, A.E., Comment on X-ray production by Pt and Os projectiles moving in thick Fe Targets with E/sub p/ = 17.30 MeV, 14:32783 (R;AU)
Spectroscopy and octupole coupling of high-spin states in /sup 213/Rn, 14:32678 (R;AU)
Stucki, H., *See* Spencer, J., 14:31770
Studart, N., *See* Aristone, F., 14:32503
Studebaker, L.D., *See* Gray, J., 14:31905
Stuerzer, I., Comparison of MRT and CT in malignant bone tumors, 14:32314 (RA;DD;In German)
NMR imaging of aseptic necroses of the head of the femur, 14:32311 (RA;DD;In German)
See Markwardt, J., 14:32315
Stukel, J.J., Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985, 14:30799 (R;US)
Styers, D.R., Tumulus Disposal Demonstration Project assessment plan for potential worker exposure: Revision 1, 14:30570 (R;US)
Stygar, W.A., The Saturn x-ray framing camera, 14:31873 (R;US)
See Fehl, D.L., 14:31851, 14:31869
Su, Y.O., Effects of solvents, axial ligation, and radical cation formation on the V=O stretching Raman frequency in vanadyl porphyrins: implications for peroxidase intermediates, 14:31498 (J;US)
See Czernuszewicz, R.S., 14:31499
Suckewer, S., *See* Aumayr, F., 14:32507
Sud, K.K., Calculation of electron-pair creation cross sections on Sn and U, 14:32495 (RA;BR)
Sudarshan, E. C. G., *See* Hagen, C. R., 14:32607
Sugarwara, T., *See* Asano, H., 14:30517
Sugimitsu, T., *See* Sugiyama, Y., 14:32667
Sugimoto, N., *See* Turner, D.H., 14:32092
Sugiyama, Y., Contribution of nucleon transfer to the elastic scattering of $^{28}Si+^{58,64}Ni$ near the Coulomb barrier, 14:32667 (J;US)
Suh, S.W., *See* Eisenberg, D., 14:32125
Sulb, S.L., *See* Zhang, Z., 14:31249
Sukhovitskij, E.Sh., *See* Klepatskij, A.B., 14:32690
Sula, M.J., Technical basis for internal dosimetry at Hanford, 14:32392 (R;US)
Sullivan, B.J., Environmental aspects of rights-of-way for natural gas transmission pipelines: An updated bibliography: Final report, September 1987–June 1988, 14:30321 (R;US)
Sullivan, E. J., *See* Candy, J. V., 14:32851
Sullivan, F.X., *See* Sampson, J.R., 14:32103
Sullivan, P.J., Acid mine drainage potential of raw, retorted, and combusted Eastern oil shale: Final report, 14:30420 (R;US)
Sullivan, S., Three-phase relative permeability of Asphalt Ridge tar sand, 14:30391 (R;US)
Summers, D.P., Electrochemical oxidation of methane at metal and oxide electrodes. Annual report, December 1, 1987-December 1, 1988, 14:31046 (R;US)
Summers, K.V., *See* Gherini, S.A., 14:32035
Sundaram, M.S., Biothermochemical conversion of a bituminous coal, 14:30245 (R;US)
Sundaram, S.K., *See* Sundaram, M.S., 14:30245
Sundloef, B., *See* Lemmeke, L., 14:30959
Sunier, J.W., *See* Byrd, R.C., 14:31824
Suomela, J., Intercalibration measurements of gamma radiating nuclides, 14:30888 (R;SE;In Swedish)
Surette, D.P., The degradation study of metals-tolerant fluid catalytic cracking catalyst by molecular probes. Final report, 14:30296 (R;CA)
Susman, S., *See* Kuriyama, K., 14:31264
Sutcliffe, P.W., *See* Morris, J.B., 14:30519
Svanum, M., *See* Ross, P., 14:31334
Svarichevskaya, E.V., *See* Isaenko, V.I., 14:32762
Svenson, O., Time orientation, planning horizons and responsibility into the future, 14:30605 (R;SE)
See Karlsson, G., 14:30606
Svensson, P., *See* Holler, H.F., 14:32149
Sviridov, V.A., *See* Golutvin, I.A., 14:31750
Svirin, M.I., Evaporation neutron spectra and nuclear level density, 14:32727 (RA;SU;In Russian)
Swalle, D.F., *See* Balchunas, A.T., 14:31443
Swain, G.R., Improvements to a transmission-line model of a main-ring cavity, 14:31752 (R;US)
Tentative design of beam focusing for the AHF linac and transport systems, 14:31757 (R;US)
Time and frequency response of beam position monitors at the Los Alamos proton storage ring, 14:31756 (R;US)
Use of the delta-t method for setting rf phase and amplitude for the AHF linac, 14:31696 (R;US)
Swaja, R.E., 1987 Neutron and gamma personnel dosimeter intercomparison study using a D_2O-moderated ^{252}Cf source, 14:31848 (R;US)
Swallow, A.J., Detection of the irradiation of foods, 14:31570 (RA;IL)
Swanson, S., Regulatory perspective on integrated value-based planning (IVP), 14:31013 (RA;US)
Sweatt, W., *See* Sawicki, R.H., 14:30642
Swenson, J. K., *See* Schulz, M., 14:32516
Swift, G. W., *See* Kotsubo, V., 14:32539
Swift, W.M., *See* Podolski, W.F., 14:30281
Swint, M.J., United States transuranium registry: Annual report, 1 October 1987–30 September 1988, 14:32372 (R;US)
Sydor, M., *See* Fingas, M., 14:30304
Sygula, A., *See* Marcinow, Z., 14:31496
See Rabideau, P.W., 14:31484
Sykes, A., *See* Clayton, R., 14:30810
Symons, R.H., *See* Forster, A.C., 14:32101
Szabo, I.C., *See* Viragh, E., 14:30883
Szeto, W.C., *See* Zanner, F.J., 14:31229
Szostak, J.W., *See* Doudna, J.A., 14:32096
Szpakiewicz, M., *See* Honarpour, M., 14:30293
Sztanyik, L.B., *See* Koeteles, G.J., 14:32386
Szymczak, W.G., *See* Bell, J.B., 14:32529

T

Tabak, H.F., Reactions mediated by yeast mitochondrial group I and II introns, 14:32097 (BA;US)

Tabatabaei, S. D., *See* Willi, O., 14:32896
Tabbert, E., Take-over of CT images by Robotron computer from Tomoscan CX, 14:32233 (RA;DD;In German)
Taboryski, R., *See* Lindelof, P.E., 14:31330
Tada, H., *See* Kuhn, R.J., 14:32197
See Paul, A.V., 14:32110
Tadios, E.L., *See* Hailey, C.E., 14:31603
Tagle, D.A., *See* Goodman, M., 14:32166
Tajima, T., Influence of attractive interaction between deuterons in Pd on nuclear fusion, 14:32703 (R;US)
Takacs, P.Z., Understanding the performance of x-ray mirrors, 14:31588 (R;US)
[International conference on synchrotron radiation application, with visits to Beijing, Hefei, and Shanghai, China, April 30–May 18, 1989]: Foreign trip report, 14:31712 (R;US)
Takada-Hidai, M., Validity of the classification of UV gallium stars, 14:32451 (RA;FR)
Takahashi, H., *See* Nakamura, Y., 14:32474
See Sahai, Y., 14:32476
Takahashi, S., *See* Enomoto, M., 14:30352
Takahashi, T., *See* Kamae, T., 14:31795
See Slagle, O.D., 14:32927
Takahashi, Y., Transverse momentum distributions and particle correlations from EMU05, 14:32680 (R;US)
Takaya, A., *See* Wroblewski, A.E., 14:31497
Takeda, H., *See* Yamanouchi, T., 14:30482
Talbot, F.D.F., *See* Lui, A., 14:31441
Taleb-Ibrahimi, A., *See* McLean, A. B., 14:31377
Talmadge, C., *See* Aronson, S., 14:32581
Tamendarov, M.F., *See* Tokmoldin, S.Zh., 14:32799
Tamura, A.T., Yucca Mountain Project bibliography, July–December 1988: An update: Civilian Radioactive Waste Management Program, 14:30529 (R;US)
Tamura, N., *See* Auer, I. P., 14:32575
Tan, H., *See* Chan, S., 14:32889
Tanaka, D. K., *See* Long, G. G., 14:31890
Tanaka, Y., *See* Nishino, H., 14:30486
Tang, A.P.C., *See* Johnson, D.C., 14:31051
Tang, C. Y., Observation of multiphoton detachment of the H^- ion, 14:32525 (J;US)
Tang, M., *See* Shi, D., 14:31300
Tang, P.K., High explosives reaction model and its application to booster performance, 14:31894 (R;US)
Tang, Y.-B., *See* Shen, G.-J., 14:30955
Tanikawa, T., *See* Cheung, P. Y., 14:32480
Tanimoto, M., *See* Matsubara, T., 14:30864
Tanner, N.K., *See* Been, M.D., 14:32093
Tanner, R.L., Atmospheric chemistry of aldehydes: enhanced peroxyacetyl nitrate formation from ethanol-fueled vehicular emissions, 14:31978 (J;US)
Tanzman, E.A., Legal aspects of implementing a global chemical weapons convention under domestic laws, 14:31169 (R;US)
Tarascon, J. M., *See* Bridges, F., 14:31308
Tarasko, M.S., *See* Malinovskij, V.V., 14:32685
Tardy, D. C., *See* Oref, I., 14:31480
Tartakovskij, V.K., *See* Evlanov, M.V., 14:32736
Tashiro, M., *See* Laskowski, M. Jr., 14:32132
Tatsumi, T., *See* Ishiwatari, M., 14:30386
Tatsumoto, K., Digestion of pretreated aspen substrates: hydrolysis rates and adsorptive loss of cellulase enzymes, 14:30715 (RA;US)
Tatum, B.A., *See* Olsen, D.K., 14:31786
Taulbjerg, K., *See* Macek, J., 14:32524
Tavendale, A.J., *See* Alexiev, D., 14:31177
Tavernier, J., *See* Auer, I. P., 14:32575
Tavlarides, L.L., *See* Bae, J.H., 14:31421
Taylor, C., *See* Gilbert, W.S., 14:31765
Taylor, R.L., *See* Chen, H.C., 14:31619, 14:31620, 14:31621
Taylor, R.W., *See* Cena, R.J., 14:30351
See Coburn, T.T., 14:30343
See Kurzeja, R.J., 14:32957
Taylor, S.R., *See* Thomas, B.J., 14:31913
Taylor, W.L., A critique of trennschaukel operation, 14:31864 (R;US)
Tchemitcheff, E., *See* Day, J.E., 14:30467
Tecklenburg, R.E. Jr., Evaluation of pulsed fast-atom bombardment ionization for increased sensitivity of tandem mass spectrometry, 14:31401 (J;US)
Teder, J., *See* Luik, H., 14:30339
Teer, B., *See* Bennett, P.C., 14:31610
Teige, S., *See* Blessing, S., 14:32559
Tellkamp, H., Age dependence of subarachnoid spaces as evidenced by CT, 14:32246 (RA;DD;In German)
Changes of the cerebral computed tomogram in children during cytostatic therapy, 14:32247 (RA;DD;In German)
See Rosenkranz, G., 14:32225, 14:32759
Temkin, A., *See* Weatherford, C.A., 14:32482
Tempel, K., *See* Golder, W., 14:32226
Tengerdy, R.P., Enhancement of cellulase production of Trichoderma reesei in fluidized bed reactor, 14:30724 (RA;US)
Teplan, V., *See* Hajek, M., 14:32260
Terabe, K., *See* Batista, A.R.D., 14:30367
Terwey, B., MRI of spinal AV-malformations, 14:32300 (RA;DD)
Tesser Junior, N.L., Contribution to the study of zinc and cadmium diffusions in InP and In/sub 0,97/ Ga/sub 0,03/ As/sub 0,08/ P/sub 0,92/ quaternary compound, 14:31199 (R;BR;In Portuguese)
Teufel, L.W., Acoustic emissions during anelastic strain recovery of cores from deep boreholes, 14:32434 (R;US)
Tharp, W.H., Short-term economic outlook. Annual review, 14:30973 (R;CA)
See Parker, J.C., 14:30974
Thatcher, R.M., *See* O'Connell, W.J., 14:30613
Theis, P., *See* Ehrlich, D., 14:30574
Theis, T.L., Kinetic studies of cadmium and ferricyanide adsorption on goethite, 14:32048 (J;US)
Theodosiou, G., *See* Auer, I. P., 14:32575
Thiell, G., *See* Bourgade, J.L., 14:31179
Thiemann, S. L., Field structure of vortex lattices in uniaxial superconductors, 14:32817 (J;US)
Thiericke, R., *See* Beale, J.M., 14:31507
Thies, M.C., *See* McCully, M.A., 14:31454
Thiessen, H.A., *See* Han, B.M., 14:31754
See Karady, G.G., 14:31753, 14:31755
Thomas, B.J., Barrierless ultrasonic air cleaner. Final report, 14:31913 (R;US)
Thomas, E.W., Metastable enhancement of C^+ and O^+ capture reactions: Annual report, July 1, 1988–June 30,1989, 14:32491 (R;US)
Thomas, G., *See* Radmilovic, V., 14:31239
Thomas, J., *See* Kasameyer, P., 14:32842
Thomauske, B., *See* Ehrlich, D., 14:30574
Thome, Z.D., *See* Claro, L.H., 14:30874
Thomee, V., *See* Bramble, J. H., 14:33016
Thompson, B.L., *See* Priatko, G.J., 14:31678
Thompson, D. L., *See* Gai, H., 14:31543
Thompson, D.H.P., *See* Lu, T., 14:31542
Thompson, J. D., *See* Aronson, M. C., 14:31305
Thompson, J.C., *See* Reed, J.H., 14:30819
Thompson, J.E., *See* Scott, C.D., 14:30247
Thompson, K.A., Transverse and longitudinal coupled bunch instabilities in trains of closely spaced bunches, 14:31724 (R;US)
Thompson, R. B., *See* Newberry, B. P., 14:31667
Thompson, R.D., *See* Zanner, F.J., 14:31229
Thompson, S.W., *See* Weis, M.J., 14:31226
Thontadarya, S.R., *See* Kerur, B.R., 14:32493
Thorne, J. M., *See* Gray, K. J., 14:31238
Thorne, J.R.G., Photophysics of the phases of poly(di-n-hexylsilane), 14:31557 (J;US)
Thornton, S.E., Procedural guide for roof bolt anchorage tests, 14:31685 (R;CA)
Thorpe, R.K., *See* Blair, S.C., 14:32435
Thorsness, P.E., Transmission of regulatory conformational changes through proteins, 14:32141 (BA;US)
Thron, A.K., *See* Terwey, B., 14:32300
Thron, J.L., The Soudan 2 proton decay experiment, 14:31801 (R;US)
Thueroff, J.W., *See* Cramer, B.M., 14:32294
Thur, W., *See* Judd, D.L., 14:32924
Thurman, J.M., Tank farm surveillance and waste status summary report for March 1989, 14:30614 (R;US)

Thykier-Nielsen, S., *See* Mikkelsen, T., 14:31909
Tian, D., *See* Wu, S. C., 14:31260
Tian, G., Investigation on the Portland pozzolana cement with more shale ash content, 14:30406 (RA;CN)
Multipurpose use of shale ash and its paragenetic mineral in China, 14:30404 (RA;CN)
Tian, H., *See* Qian, H., 14:30365
Tibbels, S.R., *See* Zamzow, D., 14:32402
Tiede, U., *See* Hoehne, K.H., 14:32320
Tien, S.S., *See* Clark, J.C., 14:31729
Tierney, J.W., *See* Chiang, Shiao-Hung, 14:30273
Tiling, R., *See* Rienmueller, R., 14:32279
Till, C.E., Evolution of the liquid metal reactor: The Integral Fast Reactor (IFR) concept, 14:30849 (R;US)
Tiller, F.M., *See* Massuda, M., 14:31456
Tillie, B., *See* Cacas, M.C., 14:30556
Timm, G., *See* Juran, R., 14:32231
See Schmidt, D., 14:32230
Timokhov, V.M., *See* Kazahov, L.E., 14:32687
See Kononov, V.N., 14:32686
Tinkler, M.J., Development of a prototype robotic system for the in-situ repair of hydraulic turbine runners, 14:31671 (R;CA)
Tinsman, J., *See* Briggs, D., 14:31853
See Levi, M., 14:31777
Tintera, J., *See* Lizler, J., 14:32282
Tittmann, E., *See* Scheffler, K., 14:30500
Tobin, M. J., Isobaric yield curves at *A*=72 from the spallation of medium mass isotopes by intermediate energy protons, 14:32671 (J;US)
Toepelmann, I., *See* Stuerzer, I., 14:32311
Toerner, L., Energy forest south. Progress report 1987-1988, 14:30739 (R;SE;In Swedish)
Toernkvist, J., *See* Herstad, S., 14:30801
Tofani, P.C., 25/sup th/ birthday of the first criticality of IPR-R1 nuclear research reactor, 14:30890 (R;BR;In Portuguese)
Toge, N., *See* Bambade, P., 14:31723
Togeby, M., Deterministic chaos in energy-technichological systems, 14:31142 (R;DK;In Danish)
Toimela, T., *See* Kapusta, J., 14:32643
Tokai, G., *See* Andrasi, A., 14:32016
Tokmoldin, S.Zh., Vibrational spectra of hydrogen containing centers in crystalline silicon, 14:32799 (R;SU;In Russian)
Toland, M.R., *See* Kuhn, W.L., 14:30572
Tominaga, H., *See* Ishiwatari, M., 14:30386
Tomita, Y., *See* Sugiyama, Y., 14:32667
Tompkins, S.B., *See* Jayanty, R.K.M., 14:31989
Tomutsa, L., *See* Honarpour, M., 14:30293
Tong, G.T., *See* Krishnan, G.N., 14:30249
Tonin Zanchin, V., *See* Recami, E., 14:32821
Topaloglu, T., Evaluation of compressed natural gas conversion systems, 14:31166 (R;CA)
Toporowicz, M., *See* Angerhofer, A., 14:31565
Torata, S., *See* Sasaki, N., 14:30501
Torgashin, Yu.V., *See* Afanasiev, V.L., 14:32455
Torget, R., *See* Abasaeed, A.E., 14:30728
See Grohmann, K., 14:30711
Torikachvili, M. S., *See* Kang, J., 14:31265
Torquato, S., *See* Lee, S. B., 14:32857
Torres V, G., Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Torrison, L.L., *See* Ramirez, J.J., 14:32930
Toth, L.M., *See* Felker, L.K., 14:31448
Touart, R., Thermal fatigue cracking of Estonian oil-shale-fired boilers' tubes caused by on-load water deslagging, 14:30403 (RA;CN)
Towner, P., *See* Davies, R.W., 14:32095
Trache, L.M., Contributions to the study of nuclei from the region Gd-146 excitation modes and interactions, 14:32721 (R;RO;In Romanian)
Trahanovsky, W.S., Observation of reactive o-quinodimethanes by flow NMR, 14:31536 (J;US)
Trail, J. A., Compact scanning soft-x-ray microscope using a laser-produced plasma source and normal-incidence multilayer mirrors, 14:31885 (J;US)
Trajmar, S., *See* Zetner, P. W., 14:32522
Tramontano, A., Catalytic antibodies, 14:32088 (BA;US)
Trampetic, J., *See* Aronson, S., 14:32581
Trangenstein, J.A., *See* Bell, J.B., 14:32530
Treinin, A., *See* Hurley, J.K., 14:31559
Treisch, J., *See* Claussen, C., 14:32298
Trentalange, S., *See* Park, I. H., 14:32570
Treuhaft, M.B., *See* Thomas, B.J., 14:31913
Treutenaere, J.M., *See* Menanteau, B.P., 14:32277
Tribble, M.J., *See* Dalgarno, B.G., 14:31315
Triebel, H.J., Thoracical high-resolution CT in pulmonary sarcoidosis, 14:32288 (RA;DD;In German)
See Spielmann, R.P., 14:32280
Trilling, G.H., *See* Adolphsen, C.E., 14:31776
Trinajstic, N., *See* Randic, M., 14:32194
Trindade, M.C., Primary radiotherapy x mastectomy in operable cancrum of breast, 14:32219 (RA;BR;In Portuguese)
Tripathi, G.N.R., Resonance Raman studies of substituent effects on the electronic structure of phenoxyl radicals, 14:31513 (J;US)
Trittmacher, S., *See* Hunsdiek, F.W., 14:32337
Trofimova, N.A., *See* Vertebnyj, V.P., 14:32691
Trombka, J.I., *See* Arnold, J.R., 14:32458
Trott, W.M., Single-pulse Raman scattering study of triaminotrinitrobenzene under shock compression, 14:31527 (J;US)
Truax, D. R., *See* Fatyga, B. W., 14:32849
Tsalko, E.A., *See* Vyskubenko, Yu.A., 14:30402
Tsang, C.-F., Monitoring of hot water plume movements in an aquifer with borhole/surface resistivity measurements, 14:30764 (RA;CA;In English and French)
See Doughty, C., 14:30936
Tsao, G.T., Acid recovery of polyamine, 14:30661 (RA;US)
Tsao, J.Y., Chemically amplified laser direct-writing of aluminum, 14:31341 (BA;US)
See Ehrlich, D.J., 14:31339
Tsao, Y.M., Improvements of enzymatic hydrolysis of cellulose: strain development of Trichoderma reesei, 14:30726 (RA;US)
Tsavachidis, C., *See* Schwarz, E.R., 14:32350
Tschirf, E., 4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook, 14:32377 (R;AT;In German, English)
Investigations on natural radiation burden in Austria, 14:31985 (RA;AT;In German)
Quarter century operational radiation protection at the Atominstitute, 14:30891 (RA;AT)
See Boeck, H., 14:30917
See Buchner, I., 14:32765
Tschirhart, R., *See* Akerlof, C., 14:32462
Tschurlovits, M., On the importance of probability distributions of parameters in dose assessments, 14:32774 (RA;AT)
Radioecological investigations in the Austrian part of the Danube river, 14:32073 (RA;AT)
See Boeck, H., 14:30917
See Buchtela, K., 14:31831
See Tschirf, E., 14:30891
Tsel'nik, F.A., On stochastic quantization, 14:32827 (R;SU;In Russian)
Tsou Sheungtsun, *See* Chan Hongmo, 14:32592
Tsuo, S., *See* Luft, W., 14:30744
Tuan, S. F., *See* Lipkin, H. J., 14:32623
Tucker, M., *See* Shiang, M., 14:30725
Tucker, M.P., Purification and partial characterization of two endoglucanases from Acidothermus cellulolyticus, 14:30722 (RA;US)
Thermostable cellulase enzymes from Acidothermus cellulolyticus: studies with growth media activities, 14:30721 (RA;US)
See Baker, J.O., 14:30716
See Tatsumoto, K., 14:30715
Tucker, M.Y., *See* Lastick, S., 14:30669
Tufts, B.J., *See* Lunt, S.R., 14:31524
Tulodieski, D.B., *See* Lee, S.G., 14:30469
Tuohy, J.M., System design for disposal of tritium at TFTR, 14:32946 (J;US)
See Cherdack, R.N., 14:32944
Turanski, A.J., *See* Krenelka, T.C., 14:31163
Turnbull, D., *See* Lu, G. Q., 14:31361

Turner, A.D., Electrical processes for the treatment of liquid wastes, 14:30458 (RA;US)
Turner, D.H., Improved parameters for prediction of RNA structure, 14:32092 (BA;US)
Turner, R.E., *See* Amick, C.J., 14:31651
Turner, R.R., Cadmium and manganese sorption by soil macropore linings and fillings, 14:32005 (J;US)
Turner, W.C., *See* Clark, J.C., 14:31729
Tweed, C.J., Guide to PICKER - a data selection program for the geochemical code PHREEQE, 14:32071 (R;GB)
Tyler, A.L., Comparison of extracts and yields from the thermal solution of a typical Green River oil shale and a Sunbury oil shale, 14:30384 (RA;CN)
Tyler, M., Contribution of atmospheric nitrate deposition to nitrate loading in the Chesapeake Bay. Final report, 14:32045 (R;US)
Tyrer, J.D., Effect of CO/sub 2/ on seamless and tubular goods, 14:31219 (R;CA)
Effect of CO/sub 2//H/sub 2/S on seamless and ERW tubular goods, 14:31220 (R;CA)
Tysoe, W.T., *See* Marchon, B., 14:31523

U

Udaja, P., *See* Dung, N.V., 14:30390
See Wall, G.C., 14:30348
Udseth, H.R., Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
Uhlenbeck, O.C., *See* Sampson, J.R., 14:32103
Uhrig, R.E., *See* Carter, R.J., 14:30791
Uken, E.A., Energetic approach towards affordable transportation, 14:31104 (R;US)
Ukraintsev, V.F., *See* Vtyurin, V.A., 14:32731
Ulpat, J.P., *See* Vergnaud, T., 14:32982
Umesono, K., *See* Ozeki, H., 14:32158
Umino, Y., Hyperon resonances in the chiral bag model, 14:32612 (J;US)
Umphres, M.D., Evaluation of the secondary effects of air stripping, 14:32044 (R;US)
Un, Sun, *See* Williams, P., 14:32210
Uncapher, W.L., The development of a mobile instrumentation data acquisition system for use in cask testing, 14:30593 (R;US)
See Madsen, M.M., 14:30591, 14:30592
Underwood, J.H., *See* Berkeland, D.J., 14:32801
Unfried, E., *See* Boeck, H., 14:30917
See Tschurlovits, M., 14:32073
Unkelbach, W., Interactions between quasiparticles and phonons in odd-even nuclei in the region of /sup 88/Sr and /sup 90/Zr, 14:32735 (R;DE;In German)
Unnikrishnan, M.P., *See* Varier, K.M., 14:32500
Untucht, M., *See* Dierkes, L., 14:30918
Uphaus, R.A., *See* Kenny, P.W., 14:31509
See Kim, J.H., 14:31520
Upper, K., *See* Fitch, W.M., 14:32155
Urbach, J. S., Low-temperature specific heat of single-crystal $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$, 14:31313 (J;US)
Urban, M., *See* Schmitz, J., 14:31828
Urbina, C., *See* Wellstood, F. C., 14:31625
Uribe, J., *See* Hartouni, E. P., 14:32561
Urin, V.N., Stable current-to-frequency converter for charged particle beam monitoring, 14:31751 (R;SU;In Russian)
Urov, K., Dependence of the yield and properties of semicoking oils on the mineral content and composition of oil shales, 14:30388 (RA;CN)
Urry, D.W., Free energy (chemomechanical) transduction in elastomeric polypeptides by chemical potential modulation of an inverse temperature transition, 14:32192 (BA;US)
Ushioda, S., *See* Giergiel, J., 14:31462
Usiu, I., *See* Yalcintas, M.G., 14:32024
Uzelac, M.J., *See* Warshawsky, A.S., 14:33030

V

Vadlamannati, S., *See* Wang, E., 14:31378
Vaelimaa, S., *See* Kosola, J., 14:30813
Vahldiek, G., *See* Terwey, B., 14:32300
Vail, L.W., A computer code for analyzing the performance of aquifer thermal energy storage systems, 14:30951 (RA;CA;In English and French)
Valencia, G., Angular correlations in the decay $B \rightarrow VV$ and *CP* violation, 14:32626 (J;US)
Valley, J.F., *See* Pfeiffer, H.J., 14:32775
Valone, S.M., Barriers to the nucleation of methyl groups on the diamond (111) surface, 14:31332 (R;US)
Van Allen, J.A., Solar-cycle dependence of the radial gradient of cosmic-ray intensity. Progress report for period ending 1988, 14:32441 (R;US)
Van Brunt, V., *See* Frantz, R.W., 14:31422
Van de Voorde, N., High temperature slagging incineration - recent operating experience, 14:30493 (RA;US)
van den Berg, A. M., *See* Lanen, J. B. J. M., 14:32660
van den Brand, J. F. J., *See* Lanen, J. B. J. M., 14:32660
van der Bruggen, R.J.A., Heating of an office building using solar energy in combination with a heat pump and seasonal heat storage, 14:30950 (RA;CA;In English and French)
Van der Horst, G., *See* Tabak, H.F., 14:32097
Van der Veen, R., *See* Tabak, H.F., 14:32097
van der Woerd, R., *See* Schwartz, A.W., 14:32082
Van Etten, J.L., *See* Xia, Y., 14:32200
van Hattem, D., *See* Catan, M., 14:30947
van Hees, A. G. M., *See* Lanen, J. B. J. M., 14:32660
Van Kooten, R., *See* Boyarski, A., 14:31854
Van Miegroet, H., The effect of nitrogen accumulation and nitrification on soil chemical properties in alder forests, 14:30701 (R;US)
Van Sciver, S.W., Liquid helium fluid dynamics studies, 14:31596 (R;US)
Van Wagner, J.H., *See* Umphres, M.D., 14:32044
van Woerkom, A.A.F., *See* Snijders, A.L., 14:30954
Vanbrabant, R., *See* Van de Voorde, N., 14:30493
Vancraeynest, J., *See* Ronan, M.T., 14:31792
Vandegrift, G.F., *See* Reichley-Yinger, L., 14:30431
Vandergrift, G.F., *See* Chaiko, D.J., 14:31420
Vandervoort, K., *See* Shi, D., 14:31300
Vane, C. R., *See* Schulz, M., 14:32516
Vanel, D., MR tissue characterization in the follow-up of primary musculoskeletal tumors, 14:32329 (RA;DD)
VanHooren, D.L., Development of technology to utilize existing tobacco kilns and/or tobacco storage barns for curing (drying) and/or storage of other crops, 14:31118 (R;CA)
Vanichseni, S., Fluidized bed combustion of Thai oil shale, 14:30400 (RA;CN)
Vaniman, D.T., *See* Heiken, G., 14:32431
Vannucci, A., Plasma's electron temperature measurements in the TBR-1 Tokamak, 14:32872 (RA;BR)
Vannucci, F., Neutrino oscillations at accelerators. Past results, future prospects, 14:32836 (R;FR)
VanPatten, J.F., *See* Wieneke, R.E., 14:32935
Vargas, C.W.S., *See* Sud, K.K., 14:32495
Varier, K.M., Elastic and inelastic scattering of 59.54 KeV gamma rays, 14:32500 (RA;BR)
Varughese, K., *See* Wang, J., 14:31552
Varughese, R., *See* Somers, B.R., 14:31190
Vashishta, P., *See* Loong, C., 14:31302
Vasil'ev, Yu.O., Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)
Vasil'eva, E.G., *See* Koval', G.N., 14:32763
Vasilenko, V.V., Low-background setup for the investigation of rare processes of nuclear decay, 14:31818 (R;SU;In Russian)
Vasudeva Rao, P.R, *See* Srinivasan, T.G., 14:30445
Vasudeva Rao, P.R., *See* Nayak, S.K., 14:30447
Vaughn, P., The numerical simulation of forward combustion in a tube reactor using the Sunnyside resource, 14:30369 (R;US)
See Sullivan, S., 14:30391
Vaughn, V.G., *See* Nielsen, M.G., 14:30495

Vavrinkova, H., *See* Hajek, M., 14:32260
Vawter, G.A., Reactive ion etching of laser structures, 14:31635 (BA;US)
Vaz Junior, M., Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus, 14:30851 (R;BR;In Portuguese)
Veal, B.W., *See* Arko, A.J., 14:31393
Vechernin, V.V., *See* Braun, M.A., 14:32710
Vedam, K., *See* Krishnaswamy, J., 14:31359
Vedoya, P., *See* Ordonez, S., 14:31210
Vedula, K., Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)
Venditti, P., *See* Donato, A., 14:30461
Venkateshan, S. P., Acoustic temperature profile measurement technique for large combustion chambers, 14:31684 (J;US)
Venkateswara Rao, N., *See* Sastry, D.L., 14:32498
Venturini, L., *See* Hiromoto, G., 14:30624
Verboncoeur, J., *See* Stallard, B.W., 14:32886
Vercauteren, D.P., *See* Boulanger, T., 14:32189
Vergnaud, T., Neutron and gamma transport in air by TRIPOLI-2 time dependent energy deposition and electron current calculation, 14:32982 (R;FR)
Verkade, J.G., *See* Wroblewski, A.E., 14:31497
Vermeer, W.J., *See* Lim, C.S., 14:32679
Vernon, D., *See* Gawlak, M., 14:30242
Vertebnyj, V.P., Total neutron cross sections and average resonance parameters of uranium 238, 14:32691 (RA;SU;In Russian)
Vetrov, P.B., *See* Alferov, V.N., 14:31741
Vibrans, J., *See* Haigh, C.P., 14:30479
Victor, N., *See* Adam, C., 14:30885
Vidal, J.C., *See* Achari, A., 14:32122
Viennot, P., *See* Iris, P., 14:30931
Vigg, S., Functional response of northern squawfish predation to salmonid prey density in McNary Tailrace, Columbia River, 14:30685 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia River Reservoir: Part II. Consumption rates of northern squawfish, walleye, smallmouth bass, and channel catfish, 14:30681 (RA;US)
See Burley, C.C., 14:30696
See Poe, T.P., 14:30680
Vigg, S., *See* Beamesderfer, R.C., 14:30690
Villa, F., A new switched power linac structure, 14:31705 (R;US)
Villanova, R., *See* Berg, B. A., 14:32604
Villela, T., Coded mask telescope for observations of X and gamma ray sources in the Southern sky, 14:31797 (RA;BR)
See Jayanthi, U.B., 14:31798
Vincent, J.B., *See* Fish, R.H., 14:30706
Vineyard, M. F., *See* Beck, C., 14:32668
Vinokurov, V.A., *See* Kiyashko, V.A., 14:31746
Vinson, J., *See* Park, I. H., 14:32570
Violante, V., *See* Anzidei, L., 14:32910
See Franconi, E., 14:32913
Violette, D.A., *See* Hill, M.K., 14:31436
Viragh, E., Aspects of controlling the radioactive waste water released by nuclear power plants at the Paks NPP, 14:30883 (RA;AT)
Virizuela, J.A., *See* Sabate, J., 14:32213
Virkar, A.V., *See* McEntire, B.J., 14:31291
Vishnevskij, L.N., Study on isomeric ratios in the /sup 45/Sc(γ,n)/sup 44mg/Sc and /sup 44/Ca(p,n)/sup 44mg/Sc reactions, 14:32666 (R;SU;In Russian)
Visscher, J., *See* Schwartz, A.W., 14:32082
Visser, M., Traversable wormholes: Some simple examples, 14:32854 (J;US)
Viswanathan, L., *See* McEntire, B.J., 14:31291
Vitorovic, D., Structural characterization of the kerogen from Pumpherston oil shale, 14:30376 (RA;CN)
Vittitoe, C.N., Did high-altitude EMP [electromagnetic pulse] cause the Hawaiian streetlight incident?, 14:31903 (R;US)
Vlieks, A.E., *See* Koontz, R.F., 14:31774
Vo-Dinh, T., *See* Alak, A.M., 14:31409
Voelker, F., Beam impedance of ferrite kicker magnets, 14:31760 (R;US)
Voevodskij, A.A., *See* Kazahov, L.E., 14:32687
See Kononov, V.N., 14:32686
Vogel, L.W., *See* Joy, D.S., 14:30523
Vogel, P., Neutrino electromagnetic form factors, 14:32611 (J;US)
Vogel, S., *See* Planitzer, M., 14:32303
Vogel, T. A., *See* Schuraytz, B. C., 14:32426
Voglewede, J., *See* Johnson, T.C., 14:30633
Vogt, O., *See* Gerward, L., 14:31326, 14:31328
See Staun Olsen, J., 14:31327, 14:31329
Vohwinkel, C., *See* Berg, B. A., 14:32604
Voit, H., *See* Oertzen, W. von, 14:32709
Volin, K. J., *See* Kuriyama, K., 14:31264
Volobuev, A.V., Grain boundary strength as point defect sink strength, 14:31211 (RA;SU;In Russian)
Volosov, A., *See* Larsson, S., 14:32178
von Goeler, S., *See* Beiersdorfer, P., 14:32890
Von Zanthier, C., *See* Kent, J., 14:31778
Vook, F.L., Basic Energy Sciences Materials Sciences programs: FWP executive summaries, 14:31228 (R;US)
Vorona, P.N., *See* Kirilyuk, A.L., 14:32653
Voropaev, S.G., Experiments on investigation of angular characteristics of power microsecond REB, 14:32874 (R;SU;In Russian)
Vosikovsky, O., Effects of attachment thickness and weld profile on fatigue life of welded joints, 14:31196 (R;CA)
Votaw, D., *See* Piacitelli, G., 14:31953
Vrieling, H., *See* Buul, P.P.W. van, 14:32373
Vries, W. de, Central registration system for on line monitoring of radioactivity concentrations and radiation levels, 14:31833 (RA;AT)
See Bos, A.J.J., 14:31841
Vtyurin, V.A., Application of the Reich-Moore formalism to description of interresonance interference in the α-decay channel of /sup 68/Zn and /sup 146/Nd compound nuclei, 14:32731 (RA;SU;In Russian)
Vukanovic, R.B., *See* Koturovic, A.M., 14:31834
Vukovic, S., *See* Markovic, P., 14:32750
Vyas, M.N., *See* Quiocho, F.A., 14:32123
Vyas, N.K., *See* Quiocho, F.A., 14:32123
Vymazal, J., *See* Kalvach, P., 14:32330, 14:32332
Vyskubenko, Yu.A., Utilization of high-sulfur shale oil in power plant integrated with gasification system, 14:30402 (RA;CN)

W

Wacker, G., Farm losses resulting from electric service interruption, 14:31132 (R;CA)
Wacknow, K.H., *See* Loew, G., 14:32181
Waddington, D., *See* Emery, K.A., 14:30738
Waganaar, W.J., *See* Rej, D.J., 14:32923
Wagner, A.F., Potential sensitivity of tunneling in isolated resonance unimolecular reaction theory, 14:31548 (J;US)
Wagner, S. R., *See* Bambade, P., 14:31730
Wagner, S.R., Risk assessment and the linearity hypothesis, 14:32385 (RA;AT)
Waite, J.H., *See* Persoon, A.M., 14:32477
Wakerley, M.W., *See* Strachan, N.R., 14:30560
Walder, A.J., *See* Alexandratos, S.P., 14:31445
Walker, B., FPL Group - a case study of diversification, 14:31028 (RA;US)
Walker, J.S., *See* Hua, T.Q., 14:32898
Wall, G.C., Kinetics of the cracking and coking of oil shale vapors and their relevance to the processing of Australian oil shales, 14:30348 (RA;CN)
Wallace, C.B., Numerical study of gyrophase and time-dependent nonadiabatic electron losses in axially symmetric magnetic mirror fields, 14:32933 (J;US)
Walling, R. S., *See* Beiersdorfer, P., 14:32890
Walmsley, D., *See* Morris, J.B., 14:30519
Walsh, W.J., *See* Marr, W.W., 14:30964
Walters, C.K., *See* Stephenson, L.C., 14:30363
Walton, M., *See* Hoyer, M.C., 14:30946
Walz, D.R., Beam dumps, stoppers and Faraday cups at the SLC, 14:31781 (R;US)
Momentum slits, collimators and masks in the SLC, 14:31780 (R;US)

Wandesforde, A., *See* Gilbert, W.S., 14:31765
Wandl, E.O., *See* Wandl-Hainberger, I., 14:32352
Wandl-Hainberger, I., Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)
Wang Dongsheng, Origin of the yellow brine and the black brine in Sichuan Basin, 14:32065 (RA;XA)
Wang Henchun, *See* Liu Cunfu, 14:32067
Wang Jiyang, *See* Fan Zhicheng, 14:32064
Wang Peiyi, *See* Liu Cunfu, 14:32067
Wang Shouzhong, *See* Zhou Shunli, 14:31805
Wang Xiangyun, *See* Wu Younghui, 14:31574
Wang Yonghai, *See* Liu Yuren, 14:31815
Wang Zhixiang, *See* Wei Keqin, 14:32058
Wang, E., Electronic instabilities of the quasi-two-dimensional monophosphate tungsten bronze $P_4W_{12}O_{44}$, 14:31378 (J;US)
Wang, F., *See* Maltman, K., 14:32599
Wang, J., Drying mechanism and kinetics model of lump-size Maoming oil shale with high moisture content, 14:30341 (RA;CN)
Polishable and robust modified graphite epoxy electrodes, 14:31552 (J;US)
Wang, J.W., Rf breakdown studies in copper electron linac structures, 14:31773 (R;US)
See Deruyter, H., 14:31772
Wang, L.K., Analytical procedures for environmental quality control. Volume 1. Technical report, 14:32041 (R;US)
Analytical procedures for environmental quality control. Volume 2. Technical report, 14:32042 (R;US)
Analytical procedures for environmental quality control. Volume 3. Technical report, 14:32043 (R;US)
Wang, M.H.S., *See* Wang, L.K., 14:32041, 14:32042, 14:32043
Wang, R., *See* Guo, S., 14:30338
Wang, S., *See* Moody, K. J., 14:32693
Wang, T., *See* Lu, Q., 14:30345
See Lu, S., 14:30377, 14:30385
See Zhao, L., 14:30329
See Zhu, Z., 14:30361
Wang, T. F., *See* Beck, C., 14:32668
Wang, T.J., Stress analysis and review of a prestressed concrete reactor pressure vessel of a HTR 500-type, 14:31323 (R;DE)
Wang, X., Study on the combustion kinetics of Fushun and Maoming shale char particles, 14:30398 (RA;CN)
Technical features of Fushun-type retort today, 14:30357 (RA;CN)
Wang, Y.C., *See* Shadle, L.J., 14:30347
Wang, Z., Relationship between oil shales and low-matured heavy oil pools in Huanghua depression, 14:30332 (RA;CN)
Studies on strength and workability of high-strength and flowing concrete utilizing low calcium oil shale ash, 14:30407 (RA;CN)
Wangler, M., *See* Finley, N.C., 14:30451, 14:30594
Wangler, T.P., Longitudinal emittance in high-current ion accelerators, 14:31720 (R;US)
Wanke, H., *See* Arnold, J.R., 14:32458
Ward, A.L., Encapsulated cesium and strontium preliminary description of waste form and canister, 14:30615 (R;US)
Ward, D.A., *See* Eaton, W.C., 14:31950
Ward, J., *See* Yu, B., 14:32510
Ward, J.A., Biological testing of sediment for the Olympia Harbor Navigation Improvement Project, 1988: Geoduck, amphipod, and echinoderm bioassays, 14:32046 (R;US)
Ward, M., *See* Barnett, C., 14:30727
Ward, W.M., *See* McBride, A.F., 14:30571
Waring, R.B., *See* Davies, R.W., 14:32095
Warner, F., Environment and nuclear war, 14:32008 (R;BR)
Warnock, R.L., Construction of symplectic full-turn maps by application of an arbitrary tracking code, 14:31727 (R;US)
See Gabella, W.E., 14:31728
Warren, D.W., *See* Lewis, M.A., 14:30524
Warren, R. G., Phenocryst abundances and glass and phenocryst compositions as indicators of magmatic environments of large-volume ash flow sheets in southwestern Nevada, 14:32428 (J;US)
See Broxton, D. E., 14:32427
Warren, R.W., *See* Feldman, D.W., 14:31628
Warren, T.W., *See* Moore, L.M., 14:31892
Warshawsky, A.S., Preliminary assessment of the impact of incorporating a detailed algorithm for the effects of nuclear irradiation on combat crew performance into the Janus combat simulation, 14:33030 (R;US)
Warwick, C.M., *See* Wilkinson, A.J., 14:32182
Wasan, D.T., *See* Menon, V.B., 14:31494
Wasik, A., *See* Marciniak, R., 14:32258
Wasserman, D.M., *See* MacDonald, J.M., 14:31071
Wasylyk, H., *See* Moschopedis, S.E., 14:30241
Watanabe, M., *See* Matsubara, T., 14:30864
Watari, T., *See* Sato, T., 14:32859
Watkins, D.B., *See* Gill, J.T., 14:32954
Watkins, M.I., *See* Yuan, H.S.H., 14:32355
Watkins, R.A., *See* Gill, J.T., 14:32954
Watson, J.S., *See* Bell, J.T., 14:31396
See Byers, C.H., 14:31449
Watson, R. E., Energetics of transition-metal alloy formation: Ti, Zr, and Hf alloyed with the heavier 4*d* and 5*d* elements, 14:31250 (J;US)
See Weinert, M., 14:31258
Watson, R.D., *See* Roth, E.P., 14:32929
Watson, R.W., *See* Weiss, E.S., 14:30335
Watson, S., *See* Kent, J., 14:31778
Waugh, D.S., *See* Pace, N.R., 14:32100
Wawersik, W.R., *See* Morgan, H.S., 14:30585
Way, J.D., *See* Noble, R.D., 14:31426
Wayne, R.P., *See* Hall, I.W., 14:31512
Weatherford, C.A., Inclusion of electron correlation for the target wave function in low- to intermediate-energy e-N_2 scattering, 14:32482 (R;US)
Weaver, N.L., Development of a second-generation, video-based luminance mapper for daylighting research, 14:31091 (R;US)
Webb, S.W., Oil velocities in the Weeks Island mine during oil recycle exercises, 14:30285 (R;US)
Weber, E., *See* Batheja, P., 14:30825
Weber, G., *See* Denison, G.J., 14:32931
Weertman, J.R., *See* Fine, M.E., 14:31175
Wei Kang, Estimation of DNA synthesis in lymphocyte as biological indicator in radiation accidents. Final report for the period 1 November 1986 - 30 November 1988, 14:32758 (R;XA)
Wei Keqin, Environmental isotope investigation of groundwaters in the region of Taiyuan, Shanxi Province of China, 14:32058 (RA;XA)
Wei Liansheng, *See* Zhu Rongbao, 14:31806
Wei Weimin, *See* Liu Yuren, 14:31815
Wei, J. Y. T., *See* Urbach, J. S., 14:31313
Wei, R.P., A 4-electrode analogue for estimating electrochemical reactions with bare metal surfaces at the crack tip, 14:31243 (J;US)
Weinberg, F., *See* Schvezov, C.E., 14:31282
Weiner, A.M., *See* Maizels, N., 14:32153
Weiner, K.H., *See* McWilliams, B.M., 14:31345
Weinert, M., Adsorbed layer and multilayer materials: The energetics and bonding of Pd and Ag on Nb(001) and Nb(110), 14:31258 (J;US)
See Watson, R. E., 14:31250
Weingart, R.C., *See* Osher, J.E., 14:31623
Weinstein, I.B., *See* Lambert, M.E., 14:32077
Weinstein, J., KK^- molecules, 14:32597 (J;US)
Weinstein, S., *See* Yonath, A., 14:32152
Weirick, L.J., Characterization of booster-rocket propellants and their simulants, 14:31895 (R;US)
Weis, M.J., The hot deformation behavior of an as-cast alloy 718 ingot, 14:31226 (R;US)
Weise, H.P., Shielding of high energy heavy ion accelerators, 14:31699 (RA;AT)
Weise, L., Determination of effective cross sections and burnup calculation for HTR-irradiations in a reflector position of the research reactor FRJ-2 (DIDO), 14:30845 (R;DE;In German)
Weisenburger, S., *See* Wiese, H., 14:30509
Weiser, G., *See* Ben-Shachar, B., 14:31840
Weisman, A.F., Startup sequence of the DWPF scale glass melter, 14:30518 (RA;US)
Weiss, E.S., Preferred explosives for blasting in oil shale mines, 14:30335 (RA;CN)
Weiss, R.B., Slippery runs, shifty stops, backward steps, and forward hops: -2, -1, +1, + 2, +5, and +6 ribosomal frameshifting, 14:32148 (BA;US)

Weiss, T., *See* Bittner, R., 14:32284
Weissburg, J.A., Manually-operated vertical articulated manipulator developed for investigation of sub-core regions, 14:31591 (RA;US)
Weisser, D.C., Corona gradient distribution system variations and homogenization, 14:31691 (R;AU)
Gridded buncher - far field extension using carbon coated teflon/sub R/ sleeves, 14:31862 (R;AU)
Welcome, M., *See* Bell, J.B., 14:32530
Welke, K.I., *See* Faler, M.P., 14:30694
Wells, J.A., Evolution of specificity and catalysis in subtilisin, 14:32144 (BA;US)
Wellstood, F. C., Hot-electron limitation to the sensitivity of the dc superconducting quantum interference device, 14:31625 (J;US)
Wels, B., *See* Johnson, D.C., 14:31051
Welty, C.S., *See* Jacob, N.P., 14:30457
Welty, T.J., *See* Swaja, R.E., 14:31848
Wemmer, D.E., *See* Pease, J.H.B., 14:32357
See Williams, P., 14:32210
Wendel, M.W., HTAS2: A three-dimensional transient shipping cask analysis tool, 14:31597 (R;US)
Wene, E.G., *See* Antonopoulos, A.A., 14:30671
Wenes, G., Random phase approximation studies in the fermion dynamical symmetry model: SO(8), 14:32743 (J;US)
Werdene, P., *See* Brennan, A., 14:30657
Werin, S., Installation of a ferrite undulator in the MAX storage ring, 14:31789 (R;SE)
Werner, E., *See* Kunkel, R., 14:31843
Werner, K., Baryon production in the central region of ultrarelativistic heavy-ion collisions, 14:32745 (J;US)
Wertz, G.W., Switch from transcription to replication of a negative-strand RNA virus, 14:32113 (BA;US)
Wesolowski, D., *See* Lawrence, N., 14:32099
Wesslau, C., *See* Gruender, W., 14:32271
West, L.E., *See* Swaja, R.E., 14:31848
Westerfield, C.L., *See* Moyer, B.A., 14:31417
Westmacott, K.H., *See* Dahmen, U., 14:31298
Whalen, R.T., Mechanical properties of particulate composites based on a body-centered-cubic Mg-Li alloy containing boron, 14:31241 (J;US)
Wham, R.M., *See* Scott, T.C., 14:30297
Whangbo, M., *See* Wang, E., 14:31378
Whatley, H.E., *See* Laskowski, M. Jr., 14:32132
Wheaton, J.H., ICRF Faraday shield plasma sheath physics: The Perkins paradigm, 14:32901 (R;US)
Wheeler, B.R., High level waste management at the Idaho Chemical Processing Plant, Idaho National Engineering Laboratory, 14:30505 (RA;US)
Whelan, D.A., *See* Bourgade, J.L., 14:31179
Wherle, R., Vacuum system development status for the APS [Advanced Photon Source] storage ring, 14:31785 (R;US)
Whitaker, J. S., *See* Hearty, C., 14:32577
Whitaker, J.M., *See* Cooley, J.N., 14:30625
White, A.L., Resource recovery facility siting: Recommendations for economic and other equity adjustments: Final report, 14:31039 (R;US)
White, C. W., *See* Lu, G. Q., 14:31361
White, C.L., *See* Heldt, L.A., 14:31192
Whitfield, S. B., *See* Sorensen, S. L., 14:32528
Whitson, C.H., *See* Soereide, I., 14:30393
Whittum, D.H., On the re-acceleration of bunched beams, 14:31722 (R;US)
Wicke, A., *See* Pensko, J., 14:31826
Wicks, G.G., Savannah River waste glass performance, 14:30513 (RA;US)
Wieczorek, H., Development and active demonstration of acid digestion of plutonium-bearing waste, 14:30483 (RA;US)
Wiel, S., Regulation of utility long-range planning, 14:31018 (RA;US)
Wieneke, R.E., Tritium emissions reduction facility, 14:32935 (J;US)
Wiese, H., Vitrification of sodium-rich high-level waste, 14:30509 (RA;US)
Wiesmann, F.J., *See* Braeutigam, K.R., 14:31928
Wiggins, D.V., *See* Sienkiewicz, C.J., 14:32952
Wiggins, R.K., *See* Wilson, S.W., 14:31624
Wikler, G.A., *See* Dohrmann, D.R., 14:31059
Wiklund, H., Optimization of the total efficiency of district heating production., 14:31153 (R;SE;In Swedish)
Wilczek, F., Problems in particle theory: Progress report, April 30, 1988–April 30, 1989, 14:32543 (R;US)
Wilde, B.E., The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel, 14:31236 (BA;US)
Wilen, P, *See* Holm, T., 14:30934
Wilhelm, A., *See* Guo, S., 14:30338
Wilhelm, R.C., *See* Carlson, R.V., 14:32943
See Coffin, D.O., 14:32949
Wilhelmy, J.B., Fission in intermediate energy heavy ion reactions, 14:32681 (R;US)
Wilkins, B. D., *See* Beck, C., 14:32668
Wilkins, M., *See* Maiden, D., 14:31897
Wilkinson, A.J., Electrostatic interactions and conformation of some thromboxane antagonists, 14:32182 (BA;US)
Wilks, S. C., Photon accelerator, 14:31710 (J;US)
Willi, O., Measurements of laser plasma coronal conditions and thermal transport with time-resolved x-ray spectroscopy, 14:32896 (J;US)
Williams, C. K., Defect generation in silicon dioxide from synchrotron radiation below 41 eV, 14:31351 (J;US)
Williams, D.R., Feasibility and analysis of fluidic-type devices in gas flow measurements. Final report, March 1987-March 1988, 14:30320 (R;US)
Williams, F.A., *See* Glassman, I., 14:31579
Williams, J.E., *See* Haigh, C.P., 14:30479
Williams, K. A., ORMONTE: A PC code for cost/risk analysis, 14:32983 (R;US)
Williams, L.C., An expert system for correlation of radar and passive sensor signals, 14:32988 (R;US)
Williams, M.A., *See* Wieneke, R.E., 14:32935
Williams, P., Following macromolecular interactions and sugar metabolism using site specific ^{3}H labelling and NMR spectroscopy, 14:32210 (R;US)
Williams, P.F.V., Organic geochemistry of the onshore Kimmeridge clay oil shale of Britain, 14:30333 (RA;CN)
Williams, R.E., *See* Bywater, R.L. Jr., 14:30646
Williams, R.L., *See* Zanner, F.J., 14:31229
Williams, R.M., *See* Prater, G.S., 14:31099
Williams, S.H., *See* Adolphsen, C.E., 14:31776
Williams, W.R., *See* Bloom, S.G., 14:31907
Williamson, A.S., Plant for immobilizing low-level aqueous waste in water extendible polymer, 14:30481 (RA;US)
Williamson, R. L., Simple compact monochromatic imaging system for plasma diagnostics, 14:31888 (J;US)
Williford, R.E., Multifractal fracture, 14:31299 (J;US)
Willis, A.S.D., *See* Haigh, C.P., 14:30479
Willis, J. O., *See* Heffner, R. H., 14:31252
Willutzki, H., *See* Chung, S. U., 14:32566
See Godfrey, S., 14:32568
Wilson, A.C., *See* Stewart, C.B., 14:32167
Wilson, C.C., Performance of prototype position-sensitive neutron detectors on SXD at ISIS, 14:31850 (R;GB)
Wilson, D.J., Correcting the error in neutron moisture probe measurements caused by a water density gradient, 14:31990 (R;AU)
Wilson, K. E., *See* Beise, E. J., 14:32658
Wilson, L.D., *See* Shub, D.A., 14:32205
Wilson, M., *See* Haseroth, H., 14:31784
Wilson, P.B., *See* Farkas, Z.D., 14:31725
Wilson, R. J., *See* Hearty, C., 14:32577
Wilson, R.G., An air management strategy for Williams Lake, 14:31915 (R;CA)
Wilson, S.W., A new glove-box system for a high-pressure tritium pump, 14:31624 (J;US)
Wilson, W.B., *See* Hermann, O.W., 14:30569
Wilt, M.J., *See* Tsang, C.-F., 14:30764
Wimmer, E., *See* Kuhn, R.J., 14:32197
See Paul, A.V., 14:32110
Windle, R.J., *See* Caves, D.W., 14:31023
Winefordner, J. D., *See* Glick, M. R., 14:31883
Winfield, R.G., Microprocessor environmental control in a large farrowing complex, 14:31117 (R;CA)

Winkelmann, H., *See* Molsen, H.P., 14:32241
Winnberg, A., *See* Lindqvist, M., 14:32460
Winsborough, W., Source-level transformations for multiple specialization of horn clauses, 14:32984 (R;US)
Winschel, R.A., Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1, 1986–March 31, 1986, 14:30252 (R;US)
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986, 14:30253 (R;US)
Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986, 14:30254 (R;US)
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987, 14:30255 (R;US)
Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987, 14:30257 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988, 14:30258 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, April 1–June 30, 1988, 14:30259 (R;US)
Improvement in coal liquefaction solvent quality by dewaxing, 14:30246 (R;US)
See Robbins, G.A., 14:30256
Winter, A.J., *See* Tabak, H.F., 14:32097
Wise, M. B., *See* Savage, M. J., 14:32627
Wise, W.N., *See* Bagnall, C., 14:30426
Wisoff, P.J., Spectroscopy of ionic alkali halide excimers excited by laser-produced plasmas, 14:31641 (BA;US)
Witten, A.J., *See* King, W.C., 14:32419
Wittig, C., *See* Xu, Z., 14:31563
Wittler, C., Development of a system for the automatic analysis of chromosome aberrations, 14:32387 (RA;AT)
Wittmann, H.G., *See* Nierhaus, K.H., 14:32146
See Yonath, A., 14:32152
Wittmann-Liebold, B., *See* Nierhaus, K.H., 14:32146
Witwer, C.R., Occupational safety and health effects of high-voltage transmission lines, 14:32405 (R;US)
Wodtke, A.M., *See* Hintsa, E.J., 14:31560
Wodtke, R.M.P., Study on the viability of upgrading Brazilian shale fines through flotation, 14:30342 (RA;CN)
Woerner, D.L., *See* Hill, M.K., 14:31436
Wojtasiewicz, A., *See* Roussiere, B., 14:32669
Wolf, D., Grain-boundary modeling, 14:31235 (BA;US)
See Lutsko, J.F., 14:31188
Wolf, K.J., *See* Gewiese, B., 14:32269
See Roemer, T., 14:32252
See Stiller, D., 14:32270
Wolf, M., *See* Michalik, M., 14:32238
See Reichmuth, B., 14:32334
Wolfe, K.H., *See* Li, W.H., 14:32162
Wolff, H., *See* Luening, M., 14:32222
Wolynes, P.G., *See* Onuchic, J.N., 14:31535
Wong, A. Y., *See* Cheung, P. Y., 14:32480
Wong, P.S., *See* Ellingson, W.A., 14:31272
Wong, R.L., Program CICC, flow and heat transfer in cable-in-conduit conductors: Equations and verification, 14:31617 (R;US)
Wood, B.J., *See* Krishnan, G.N., 14:30249
Wood, D. M., *See* Froyen, S., 14:31358
Wood, H.C., *See* Baker, R.S., 14:30516
Wood, S. A., *See* Beise, E. J., 14:32658
Woodall, A., Windscale Vitrification Plant and vitrified product store, 14:30498 (RA;US)
Woodall, K.B., Application of lasers to CANDU nuclear fuel reprocessing, 14:30439 (RA;US)
Woodbridge, E.L., Photofragmentation of acetone at 193 nm: rotational- and vibrational-state distributions of the CO fragment by time-resolved FTIR emission spectroscopy, 14:31561 (J;US)
Woodruff, D. P., *See* Kilcoyne, A. L. D., 14:31259
Woods, C.L., Measurement of the mass of /sup 39/Sc, 14:32488 (R;AU)
Studies of the T/sub Z/ = 5/2 nuclei /sup 31/Al and /sup 29/Mg, 14:32661 (R;AU)
See Ophel, T.R., 14:31802
Woods, M.C., *See* Gangwal, S.K., 14:30250
Woods, P.J., *See* Fifield, L.K., 14:32662
Woods, T.O., High temperature mechanical properties and microscopic examination of extruded powder aluminum, 14:31194 (R;US)
Woodward, C., *See* Garner, J., 14:32813
Woodward, C.A., *See* Scott, C.D., 14:30247
Woodward, J., Hydrolysis of cellulose by purified cellulase components: synergistic effects, 14:30720 (RA;US)
Woolsey, N.F., Metal arene complexes in coal structure determination: Quarterly reports, September 1988–February 1989, 14:30270 (R;US)
Word, J.Q., *See* Ward, J.A., 14:32046
Workman, R. L., Coupling constants in kaon photoproduction, 14:32744 (J;US)
Worley, G.L., Radioactive waste volume reduction program at Brunswick Nuclear Project, 14:30542 (RA;US)
Worlock, J.M., *See* Cox, H.M., 14:31231
See Morais, P.C., 14:31230
Wormersley, W.J., *See* Strovink, M., 14:31811
Wormser, G., *See* Levi, M., 14:31777
Wozniak, G.J., *See* Moretto, L.B., 14:32670
Wrench, H., *See* Macken, J., 14:31649
Wright, D. H., *See* Leitch, M. J., 14:32657
Wright, J., *See* Grohmann, K., 14:30711
Wright, J.D., Ethanol from lignocellulose: the DOE/SERI Biochemical Conversion/Alcohol Fuels Program, 14:30655 (RA;US)
Overview of acid hydrolysis of lignocellulosics to liquid fuels, 14:30656 (RA;US)
Overview of enzymatic hydrolysis research, 14:30663 (RA;US)
See Hinman, N.D., 14:30668
Wright, L. E., *See* Bennhold, C., 14:32602
Wright, P.L., Thick seam mining methods review of CMRC literature search, 14:30279 (R;CA)
Wright, P.M., Exploration for direct heat resources, 14:30762 (RA;US)
Nature of geothermal resources, 14:30760 (RA;US)
Wroblewski, A.E., Experimental and theoretical study of the structures and optical rotations of chiral bicyclic ortho esters, 14:31497 (J;US)
Wroblewski, J. P., *See* Novaco, A. D., 14:31369
Wu Chuanchu, *See* Wu Younghui, 14:31574
Wu Younghui, Labelling of TTHA coupled IgG and MCAb with rare earth radionuclides. I. research on labelling process, 14:31574 (R;AU)
Wu Zhijun, *See* Cheng Caie, 14:32070
Wu, R., Comparison of Fischer assay shale oils produced from different oil shales, 14:30389 (RA;CN)
Wu, S. C., Relativistic effects in the electronic structure of Cu{001}, 14:31260 (J;US)
Wu, W., Erosion of Al and Al/SiC, 14:31269 (R;US)
Wu, X., *See* Qin, K., 14:30387
Wudka, J., Variational calculations and Bogolubov transformations, 14:32638 (J;US)
Wuebbles, D.J., Beyond CO_2: The other greenhouse gases, 14:31972 (R;US)
See Connell, P.S., 14:31974
See Kinnison, D.E., 14:31973
Wyman, C., *See* Mohaghegni, A., 14:30723
Wyman, C.E., *See* Bynum, M.T., 14:30712
See Hinman, N.D., 14:30668
See Spindler, D.D., 14:30667
See Wright, J.D., 14:30656
Wysin, G. M., *See* Gouv@/re@, 14:32811

X

xa, M. E., *See* Gouv@/re@, 14:32811
Xia, Y., Site-specific single strand endonuclease activity induced by NYs-1 virus infection of a Chlorella-like green alga, 14:32200 (J;GB)

Xiao, Q., *See* Han, Z., 14:30405
Xie Yali, *See* Liu Yuren, 14:31815
Xie, D., *See* Yao, M., 14:30418
Xie, J., Theoretical studies of the energetics and structures of atomic clusters, 14:31485 (J;US)
Xie, R., *See* Yang, Q., 14:30375
Xiong Jincheng., Erratic time dependence of orbits of topologically mixing maps, 14:32820 (R;XA)
Xu, M.Q., *See* Shub, D.A., 14:32205
Xu, Y., *See* Axe, J. D., 14:31303
Xu, Z., Determining reaction pathways and spin-orbit populations in the photodissociation of HBr and HI using velocity-aligned Doppler spectroscopy, 14:31563 (J;US)
See Tian, G., 14:30404
Xudong, C., *See* Hansen, A., 14:30790
Xue, T., Application of the pH-stat technique in Donnan dialysis: effect of anion invasion in the $CoSO_4$/Nafion 117/H_2SO_4 system, 14:31440 (J;US)

Y

Yablonovitch, E., *See* Cox, H.M., 14:31231
See Morais, P.C., 14:31230
Yabushita, T., Development of oil shale retorting plant in Japan. Part II. Operation of the pilot plant, 14:30355 (RA;CN)
Yahagi, M., *See* Kuriyama, K., 14:31264
Yakushev, V.P., *See* Anikejchik, A.M., 14:31743
Yalcintas, M.G., Correlation between thorium concentrations in soil and gamma readings in FUSRAP site in New Jersey, 14:32024 (J;US)
Results of the independent radiological verification survey of the lower Sheffield Brook floodplain, Wayne, New Jersey, 14:32021 (R;US)
See Fields, D.E., 14:32023
Yama, Z., *See* Akerlof, C., 14:32462
Yamagishi, H., *See* Carrington, M. E., 14:32596
Yamaguchi, H., *See* Asano, H., 14:30517
Yamamoto, M., Progress in the remote handling equipment, 14:30491 (RA;US)
See Sasaki, N., 14:30501
See Yamanouchi, T., 14:30482
Yamanishi, T., *See* Sherman, R.H., 14:32963
Yamanouchi, T., Immobilization of medium-level waste at Tokai Reprocessing Plant, 14:30482 (RA;US)
Yamao, F., *See* Osawa, S., 14:32157
Yamshchikov, M.A., *See* Laptev, A.B., 14:32749
Yan, G., *See* Li, C., 14:30413
Yan, J., Analysis and in-cylinder measurement of particulate radiant emissions and temperature in a direct-injection diesel engine, 14:31156 (R;US)
Yan, Z., Study of nonsteady-state continuous membrane column for gas separation, 14:31438 (J;US)
Yang Liucheng, *See* Zhu Rongbao, 14:31806
Yang Zhongyao, *See* Li Xueli, 14:32068
Yang, A.B., *See* Arko, A.J., 14:31393
Yang, C.F., *See* Paul, A.V., 14:32110
Yang, I., Thermal conductivity of deformed potassium chloride, 14:31380 (J;US)
Yang, J., Heat-transfer predictions and experiments in a motored engine, 14:31155 (R;US)
Investigation on pyrolysis of Huangxian oil shale between 550° 750°C, 14:30344 (RA;CN)
Sixty years of oil shale retorting industry in Fushun, 14:30368 (RA;CN)
Yang, M. H., Growth of alkali halides from molecular beams: Global growth characteristics, 14:31360 (J;US)
Yang, Q., Investigation of the structure of kerogens based on the oxidation products from multistep alkaline permanganate degradation, 14:30375 (RA;CN)
See Cao, Z., 14:30382
Yang, S., *See* Causgrove, T.P., 14:31531
Yang, Y., *See* Liang, G., 14:30415
Yaniv, S.S., *See* Filipy, R.E., 14:32376
Yao, M., Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
Yao, Y., *See* Kaufman, W. A., 14:32610
Yariv, Y., *See* Byrd, R.C., 14:31824
Yasue, K., *See* Albeverio, S., 14:32838
Yasunaga, T., *See* Miyata, T., 14:32164
Yates, B.F., Infrared spectrum of $F^- \times H_2O$, 14:31534 (J;US)
Yates, J.T. Jr., *See* Panayotov, D., 14:31529
Yates, S. W., *See* Mann, L. G., 14:32676
Yatos, I.C., Effect of carbon dioxide on the kinetics of the Fischer-Tropsch synthesis on iron catalysts, 14:30267 (J;US)
Yavorskij, V.A., *See* Goloborod'ko, V.Ya., 14:32879
Ye, Q., *See* Cai, M., 14:30419
Yeager, E., *See* Razaq, M., 14:31047
Yefimov, V.M., Large capacity aggregates for retorting lump oil shale, 14:30356 (RA;CN)
Yeh, H.C., *See* Ellingson, W.A., 14:31272
Yelton, J.L., *See* Sullivan, P.J., 14:30420
Yen, T.F., *See* Lee, A.S., 14:30337
Yen, Teh Fu, Microbial screening test for lignite degradation: Final report, 14:30260 (R;US)
Yeo, I.H., *See* Johnson, D.C., 14:31051
Yeung, E. S., *See* Hogan, B. L., 14:31404
See Kawazumi, H., 14:31881
Yeung, E.S., *See* Wroblewski, A.E., 14:31497
Yi, B., *See* Cai, M., 14:30419
Yin, S., *See* Ma, X., 14:30328
Yokomi, H., *See* Takahashi, Y., 14:32680
Yonath, A., Approaches to the determination of the three-dimensional architecture of ribosomal particles, 14:32152 (BA;US)
York, E.J., *See* Shoemaker, K.R., 14:32116
Yorkey, T.J., *See* Daily, W., 14:32423
Yoshida, H., *See* Sherman, R.H., 14:32963
Yoshida, T., High-resolution measurement of massive-dielectron production in 800-GeV proton-beryllium collisions, 14:32579 (J;US)
Yoshimura, H.R., Force and moment reconstruction for a nuclear transportation cask using sum of weighted accelerations and deconvolution theory, 14:30602 (R;US)
See Attaway, S.W., 14:31613, 14:31614
You, L., *See* Guo, S., 14:30354
Young, J.P., *See* Shaw, R.W., 14:31408
Young, J.R., *See* Witwer, C.R., 14:32405
Young, K. K., *See* Hearty, C., 14:32577
Young, L., *See* Mansour, N. B., 14:32521
Young, P.P., Low pressure sodium roadway lighting, 14:31141 (R;CA)
Younker, L. W., *See* Schuraytz, B. C., 14:32426
Younker, L.W., Earth Sciences annual report, 1987, 14:30612 (R;US)
Ypma-Wong, M.F., *See* Kuhn, R.J., 14:32197
Yu, B., The Far-IR spectra of UO_2, α-U_3O_8, and γ-UO_3 using the light pipe reflection method, 14:32510 (J;US)
See Debbe, R., 14:31803
Yu, C. C., *See* Coppersmith, S. N., 14:32808
Yu, David U.L., *See* Whittum, D.H., 14:31722
Yu, L.P., Changes in Rhodospirillum rubrum cytochrome c_2 and subsequent renaturation: An ^{15}N NMR study, 14:32356 (J;US)
Yu, Shirley K.-T., *See* Green, J.B., 14:30312
Yuan, H.S.H., Determination of the absolute configuration of (-)-(2R)-succinic-2-d acid by neutron diffraction study: Unambiguous proof of the absolute stereochemistry of the NAD^+/NADH interconversion, 14:32355 (J;US)
Yule, H.P., *See* Gray, J., 14:31905
Yung-Fu, S., Economical effect of the introduction of aquifer cold preservation for air-conditioning and temperature lowering of Shanghai Hongqido Airport, 14:30952 (RA;CA;In English and French)
Yurov, A.A., *See* Grebenyuk, S.V., 14:31745
Yuta, K., *See* Yabushita, T., 14:30355
Yvert, M., *See* Mours, B., 14:32834

Z

Zabdyr, J., *See* Walz, D.R., 14:31780

Zabransky, R.F., Thermally initiated carbon-carbon bond-cleavage reactions occurring during coal gasification. Final report, April 1985-June 1988, 14:30265 (R;US)
Zachary, A.L., *See* Max, C.E., 14:32463
Zachos, C.K., Fermionic center in the superconformal algebra on the supertorus, 14:32819 (R;US)
Zadorozhny, A.M., *See* Ambjoern, J., 14:32635
Zaebst, D.D., Walk-through survey report, Central Brass Manufacturing Company, Cleveland, Ohio, March 20, 1987, 14:31956 (R;US)
Zahed, I., *See* Carrington, M. E., 14:32596
Zahradnik, R.L., *See* Hulsebos, J., 14:30360
Zaidi, A., Field testing and monitoring of two high efficiency condensing gas boilers installed in a highrise building, 14:31682 (R;CA)
Zalkin, A., *See* Brennan, J.G., 14:31578
Zambrini, J.C., *See* Albeverio, S., 14:32838
Zamick, L., Mechanisms for spin suppression and orbital enhancement in *M*1 transitions: Critical assessment, 14:32742 (J;US)
Zampaglione, V., *See* Anzidei, L., 14:32910
See Franconi, E., 14:32913
Zamzow, D., Fluorescence line narrowing spectrometric analysis of benzo[a]pyrene-DNA adducts formed by one-electron oxidation, 14:32402 (J;US)
Zanardi, M.C., *See* Moraes, R.V. de, 14:31860
Zanner, F.J., Vacuum arc remelting of Alloy 718, 14:31229 (R;US)
Zapalac, G., *See* Ronan, M.T., 14:31792
Zapata, L.E., Absolute intensity, high resolution spectrum of the vortek arc lamp and its spectral match to Nd:YAG bands, 14:31633 (R;US)
Zardecki, A., High-energy laser-assisted imaging through vaporizing aerosols, 14:31636 (BA;US)
Zaug, A.J., *See* Been, M.D., 14:32093
Zawadzkas, G.A., *See* Ramirez, J.J., 14:32930
Zdesenko, Yu.G., *See* Zhuk, N.A., 14:31821
Zdzienicka, M.Z., *See* Buul, P.P.W. van, 14:32373
Zeeck, A., *See* Beale, J.M., 14:31507
Zeeh, A., *See* Shub, D.A., 14:32205
Zehner, D. M., *See* Lui, S., 14:31262
Zeigler, J.M., *See* Thorne, J.R.G., 14:31557
Zeisler, R., Sequential determination of biological and pollutant elements in marine bivalves, 14:31460 (J;US)
Zelevinckij, V.G., On statistical theory of overlapping resonances, 14:32724 (RA;SU;In Russian)
Zellerhoff, W., *See* Bogun, K.R., 14:32251
Zeng Jishu, *See* Zhuang Huie, 14:32006
Zerek, A.T., *See* Tharp, W.H., 14:30973
Zetner, P. W., Problems associated with the measurement of coherence parameters: Superelastic electron scattering by laser-excited ^{138}Ba(...6s6*p* $^1P_1$) atoms, 14:32522 (J;US)
Zettl, A., *See* Jeffries, C. D., 14:31307
Zettwoog, P., *See* Charuau, J., 14:32769
See Schmitz, J., 14:31828
Zha, C. S., *See* Hemley, R. J., 14:31370
Zhak, A., *See* Vtyurin, V.A., 14:32731
Zhang Yonghui and others, Study of computational method about equations for laser fusion with superthermal electron transport and its applications, 14:32897 (R;CN;In Chinese)
Zhang Yulei, *See* Wu Younghui, 14:31574
Zhang Zengrui, *See* Zhu Rongbao, 14:31806
Zhang Zhigan, Environmental isotope study related to groundwater age, flow system and saline water origin in Quaternary aquifers of North China Plain, 14:32055 (RA;XA)
Zhang, G., *See* Cao, Z., 14:30382
See Yang, Q., 14:30375
Zhang, J. Z. H., Reply to Comment on: Accurate three-dimensional quantum scattering calculations for $F+H_2 \rightarrow HF+H$, 14:31550 (J;US)
Zhang, Y., *See* Lu, S., 14:30385
See Zhu, Z., 14:30361
Zhang, Y.D., *See* Zhang, Z., 14:31249
Zhang, Z., Spin echo NMR of cobalt zeolite catalysts: control of particle size and structure, 14:31249 (J;US)
Zhao, G., Microscopic real-space approach to the theory of metallic glasses, 14:31248 (J;US)
Zhao, L., Feature of distribution and suggestion on the development and utilization of oil shale in China, 14:30329 (RA;CN)
Zhao, Q., *See* Cao, Z., 14:30382
Zhao, Y., Electrochemical oxidation of oil shale, 14:30396 (RA;CN)
Zhao, Z., Initiation and development of fluidized-bed boilers for oil shale in China, 14:30408 (RA;CN)
Zheltonozhskij, V.A., *See* Gavrilyuk, V.I., 14:31822
See Vishnevskij, L.N., 14:32666
Zheng Hualing, *See* Zhou Shunli, 14:31805
Zheng, D. C., *See* Zamick, L., 14:32742
Zheng, X., High-order corrections to the image potential, 14:32815 (J;US)
Zheng, Z., Stress induced microcrack geometry at failure in unconfined and confined axial compressive tests, 14:32432 (R;US)
Zhou Bingguan, Radioisotope distribution characteristics of the groundwater system in volcanic-type U deposits and isotope-dating estimation of the system, 14:32069 (RA;XA)
Zhou Shunli, Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent extraction-liquid scintillation count method, 14:31805 (R;CN;In Chinese)
Zhou, X., *See* Tian, G., 14:30404, 14:30406
Zhou, Y.P., *See* Kim, W.Y., 14:32421
Zhu Lanying, *See* Zhuang Huie, 14:32006
Zhu Rongbao, On-line monitor for cation exchange elution chromatography using lithium silicate glass beads as solid scintillator, 14:31806 (R;CN;In Chinese)
Zhu, S., Sorption of pyridine and quinoline onto rundle spent shale, 14:30421 (RA;CN)
Zhu, X. D., Generation and detection of a monolayer grating by laser desorption and second-harmonic generation: CO on Ni(111), 14:32805 (J;US)
Zhu, Y., *See* Lu, Q., 14:30345
See Wang, X., 14:30398
See Zhu, Z., 14:30361
Zhu, Z., Preliminary study on hydrotreating of a high sulfur content shale oil, 14:30361 (RA;CN)
See Cai, M., 14:30419
Zhuang Huie, Research on the adsorption of technetium and iodine in some minerals, 14:32006 (R;CN;In Chinese)
Zhuk, N.A., Precision impulse generator for stabilization of a semiconductor spectrometer, 14:31821 (R;SU;In Russian)
Zhuk, N.A. and others, *See* Vasilenko, V.V., 14:31818
Ziebarth, R.P., *See* Chu, P.J., 14:31518
Ziegengeist, S., *See* Michalik, M., 14:32238
Zielinska, B., Nitration of acephenanthrylene under simulated atmospheric conditions in solution and the presence of nitroacephenanthrylene(s) in ambient particles, 14:31979 (J;US)
Zielinski, M., Primakoff production of hybrid mesons, 14:32560 (J;US)
Ziemba, F., *See* Dunham, M. E., 14:31884
Zieminska, D., E/ι in hadroproduction, 14:32552 (J;US)
See Blessing, S., 14:32559
See Chung, S. U., 14:32566
Zillman, W., *See* Mote, J.D., 14:30804
Zimmer, E., Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)
Zimmer, K. W., Highly excited nuclei state and level densities, 14:32716 (R;RO;In Romanian)
Zimmerman, D. S., *See* Shegelski, M. R. A., 14:32814
Zimmerman, G.P., *See* LaFontaine, H., 14:30674
Zimmerman, R.M., Results of pressurized-slot measurements in the G-Tunnel underground facility, 14:30589 (R;US)
Zimmermann, H., Mechanical properties of lithium silicates for fusion reactor breeder blankets, 14:32922 (R;DE;In German)
Zimmermann, R.A., CT and MRI of the brain, 14:32237 (RA;DD)
Zimmt, M.B., *See* Dorfman, R.C., 14:31556
Zinkann, G., New fast tuning system for the Atlas Accelerator, 14:31732 (R;US)
Zinkann, G.P., *See* Bogaty, J.M., 14:31692
Zinov'ev, G.M., *See* Borisenko, O.A., 14:32631
See Goloviznin, V.V., 14:32587
Ziolkowski, R.W., New electromagnetic directed energy pulses, 14:32839 (R;US)
Zippel, H., *See* Haehnel, H., 14:32310
Zisk, M., *See* Dickinson, P. H., 14:31296

Zoback, M.D., State of stress and the relation to tectonics in the central Savannah River area of South Carolina, 14:32429 (R;US)
Zoetelief, J., *See* Bos, A.J.J., 14:31841
Zombori, P., *See* Andrasi, A., 14:32016
Zschenderlein, R., Diagnostic value of NMR imaging in myopathies, 14:32248 (RA;DD;In German)
Zuhr, R.A., *See* Appleton, B.R., 14:31346
Zunger, A., *See* Froyen, S., 14:31358
Zuo, J., *See* Pandey, R., 14:31372
Zur, C., CT-aided specimen collection - an alternative to stereotaxic cerebral biopsy, 14:32242 (RA;DD;In German)
Zutavern, F.J., Photoconductive semiconductor switch (PCSS) recovery, 14:31672 (R;US)
See Loubriel, G.M., 14:31673
Zydney, A.L., *See* Robertson, B.C., 14:31437

Subject Index

This index is arranged by subject descriptors selected from those assigned to each citation in this publication. Subject descriptors are selected from a controlled thesaurus of terms, *EDB Subject Thesaurus* (DOE/OSTI-7000). In order to enhance indexing, subject descriptor entries generally consist of a pair of descriptors: a main term and a qualifier term. Each entry includes the full title (which may be followed by supplementary descriptive information in parentheses) and the citation number. Additional information given in parentheses indicates the document type (an abbreviation such as B for book), the country of publication (such as DE for Federal Republic of Germany), and the language if non-English.

See references guide users from synonymous terms to the descriptors selected for the concept. *See also* references indicate subject concepts that are more specific than a particular descriptor. To gain complete subject coverage, all such terms should be reviewed.

A

A CODES
PC-based calculation of activation energy using linear regression, 14:30900 (R;US)

A RESONANCES
See MESONS

A0-980 MESONS
Physical Properties
Mass dependent fits of the partial wave analysis of the $K^+\bar{K}0\pi-$ system, 14:32559 (J;US) Search for A J^{PC} exotic hybrid meson, 14:32566 (J;US)

A2H-1320 RESONANCES
See MESONS

A2L-1280 RESONANCES
See MESONS

ABANDONED SHAFTS
Backfilling
Multipurpose use of shale ash and its paragenetic mineral in China, 14:30404 (RA;CN)

ABANDONED SITES
Site Surveys
Results of the independent radiological verification survey of the lower Sheffield Brook floodplain, Wayne, New Jersey, 14:32021 (R;US)

ABDOMEN
Nmr Imaging
Gd-DTPA - a positive oral contrast medium in abdominal MR tomography, 14:32234 (RA;DD;In German)

ABERRATION YIELD
See MUTATION FREQUENCY

ABNORMALITIES (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS

ABSORBED DOSES
See RADIATION DOSES

ABSORBED FRACTION (INTERNAL IRRADIATION)
See INTERNAL IRRADIATION

ABSORPTION
Mathematical Models
Radon generation, adsorption, absorption, and transport in porous media, 14:31062 (R;US)

ABSORPTION REFRIGERATION CYCLE
Economics
Cost reduction in absorption chillers: Phase 2, 14:31056 (R;US)

ABSORPTION SPECTROSCOPY
Calculation Methods
Optical technique for broadband microwave absorption spectroscopy in aqueous media, 14:31637 (BA;US)

ACCELERATOR FACILITIES
See also STANFORD LINEAR COLLIDER
Construction
Proceedings of the DOE workshop on the role of a high-current accelerator in the future of nuclear medicine, 14:32348 (R;US)
Uses
Proceedings of the DOE workshop on the role of a high-current accelerator in the future of nuclear medicine, 14:32348 (R;US)

ACCELERATORS
See also ELECTROSTATIC ACCELERATORS
HEAVY ION ACCELERATORS
LINEAR ACCELERATORS
PARTICLE BEAM FUSION ACCELERATOR
Aerial Monitoring
Long-term experience in mixed field radiation monitoring, 14:32770 (RA;AT)
Computerized Control Systems
Accelerator diagnosis and control by Neural Nets, 14:31703 (R;US)
Personnel
Long-term experience in mixed field radiation monitoring, 14:32770 (RA;AT)
Radiation Protection
Radiation protection dosimetry of neutrons and photons at a high energy accelerator using a low pressure proportional counter, 14:31842 (RA;AT)

ACCIDENTAL INTAKE
See ACCIDENTS

ACCIDENTAL IRRADIATION
See IRRADIATION

ACCIDENTS
See also REACTOR ACCIDENTS
Health Hazards
An analysis of the consequences of accidents involving shipments of multiple Type A radioactive material (RAM) packages, 14:30594 (R;US)
Historical Aspects
An analysis of the background and development of regulations for the air transport of plutonium in the USA, 14:30596 (R;US)
Public Information
Standby after the Chernobyl accident, 14:30907 (R;SE;In Swedish)

ACCUMULATION (RADIOECOLOGICAL)
See RADIOECOLOGICAL CONCENTRATION

ACES
See QUARKS

ACETATES
Dissociation
Infrared multiphoton dissociation of ethyl and methyl acetate, 14:31560 (J;US)
Permeability
Permeation of gas mixtures in cellulose acetate membranes - practical approach to predict the permeation rate CO_2/CH_4 mixture, 14:31457 (J;US)
Porosity
Studies on gas transport through dry cellulose acetate membranes prepared by solvent exchange technique, 14:31441 (J;US)

Thermodynamic Properties
Potentiometric determination of the molal formation constants of ferrous acetate complexes in aqueous solutions to high temperature, 14:31538 (J;US)

ACETIC ACID
Adsorption
Infrared study of carbon on alumina, 14:31182 (R;US)
Dehydration
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
Phase Diagrams
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)

ACETONE
Photolysis
Photofragmentation of acetone at 193 nm: rotational- and vibrational-state distributions of the CO fragment by time-resolved FTIR emission spectroscopy, 14:31561 (J;US)

ACETYLENES
See ALKYNES

ACID ELECTROLYTE FUEL CELLS
Electrolytes
Electrochemical characteristics of acid electrolytes for fuel cells. Final report, August 1, 1985-December 31, 1988, 14:31047 (R;US)
Performance
Development of ternary alloy cathode catalysts for phosphoric acid fuel cells: Final report, 14:31043 (R;US)

ACID HYDROLYSIS
Mathematical Models
Effect of non-uniform temperature distribution on acid hydrolysis of Aspen hemicellulose, 14:30728 (RA;US)

ACID RAIN
Air Pollution Monitors
Quality-assurance audits of the EPA (Environmental Protection Agency) state-operated precipitation-collection network: 1987, 14:31950 (R;US)
Biological Effects
Dutch priority programme on acidification: Summary report, Acidification research, 1984–1988, 14:31969 (R;NL)
Control
The role of regional activity forecasts in projecting emission trends of acid deposition precursors, 14:31918 (R;US)
Dictionaries
Vocabulary of acid precipitation and air pollution. Terminology bulletin 175, 14:31970 (R;CA;In English and French)
Environmental Effects
The present and potential effects of acidic and acidifying air pollutants on Alberta's environment. Summary report, 14:31923 (R;CA)
Environmental Impacts
The present and potential effects of acidic and acidifying air pollutants on Alberta's environment. Summary report, 14:31923 (R;CA)
Mathematical Models
Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985, 14:30799 (R;US)
Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988, 14:30800 (R;US)
Quantitative Chemical Analysis
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
Research Programs
Acid precipitation in Ontario study, annual program report, 1987/1988, 14:31935 (R;CA)
Effects of acidic precipitation and related pollutants in the terrestrial environment. A program description, 14:31997 (R;CA)
Sampling
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)

ACIDS (ORGANIC)
See ORGANIC ACIDS

ACOUSTIC MEASUREMENTS
Mathematical Models
Model-based passive ranging, 14:32851 (J;US)

ACPR REACTOR
Reactor Safety
Technical Safety Appraisal of the Sandia reactors, ACRR [Annular Core Research Reactor], SPR III [Sandia Pulse Reactor III], Sandia National Laboratories, Albuquerque, 14:30899 (R;US)

ACQUIRED IMMUNODEFICIENCY SYNDROME
See AIDS

ACRR REACTOR
See ACPR REACTOR

ACRYLAMIDE
Electrophoresis
Indirect fluorometric detection in gel electrophysics, 14:31404 (J;US)
Thermodynamic Properties
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)

ACRYLATES
Solubility
Improvement of CO_2 flood performance: Quarterly report, October–December 1988, 14:30291 (R;US)

ACRYLONITRILE
Air Pollution Monitoring
Development and validation of a test method for acrylonitrile emissions, 14:31951 (R;US)
Gas Analysis
Development and validation of a test method for acrylonitrile emissions, 14:31951 (R;US)

ACTINIDES
See also AMERICIUM
CURIUM
PLUTONIUM
THORIUM
URANIUM
Biological Effects
Biological assessment of occupational exposure to actinides: Programme; Book of Abstracts, 14:32368 (R;FR)
Solvent Extraction
Potentiality of nonorganophosphorus extractants in chemical separations of actinides, 14:30443 (J;US)
Restoring solvent for nuclear separation processes, 14:30444 (J;US)
TRUEX process and the management of liquid TRU waste, 14:30619 (J;US)

ACTINIUM D
See LEAD 207

ACTIVATED CARBON
Sorptive Properties
Fluorine gettering by activated charcoal in a radiation environment, 14:31448 (J;US)

ACTIVATED SLUDGE PROCESS
Microorganisms
Bio-adsorption (Pilot-scale). Investigation of cleansing effect and sludge formation, 14:31145 (R;DK;In Danish)

ACTIVATION ANALYSIS
Performance
Neutron activation analysis possibilities for the elemental composition research in oil-shales, oil-bituminous rocks, petroleum and their fractions, 14:30379 (RA;CN)

ACTIVATION ENERGY
Computer Calculations
PC-based calculation of activation energy using linear regression, 14:30900 (R;US)
a Codes
PC-based calculation of activation energy using linear regression, 14:30900 (R;US)

ACTIVATION HEAT
See ACTIVATION ENERGY

ADAPTED SWIMMING POOL REACTOR AUSTRIA
See ASTRA REACTOR

ADDITIVES
See also FUEL ADDITIVES

Performance Testing
High explosives reaction model and its application to booster performance, 14:31894 (R;US)

ADDUCTS
See also DNA ADDUCTS
Evaporation
Evaporation from small particles, 14:31526 (J;US)

ADENOCARCINOMAS
See CARCINOMAS

ADENOMAS
Pituitary Gland
Gd-DTPA in hypophyseal microadenoma diagnosis, 14:32275 (RA;DD;In German)
Radiotherapy
Results of postoperative radiotherapy and radiation of recurrent tumours, observed in adenomas of the pituitary gland operated at a primary stage, 14:32344 (R;DE;In German)

ADENOSINE TRIPHOSPHATASE
See ATP-ASE

ADENOSINE TRIPHOSPHATE
See ATP

ADRENAL GLANDS
Computerized Tomography
CT and MRI of kidney, adrenal and abdominal lymph nodes, 14:32290 (RA;DD)
What are the limits of a CT examination in diagnosing adrenal tumours?, 14:32342 (RA;DD)
Neoplasms
What are the limits of a CT examination in diagnosing adrenal tumours?, 14:32342 (RA;DD)
Nmr Imaging
CT and MRI of kidney, adrenal and abdominal lymph nodes, 14:32290 (RA;DD)

ADSORBENTS
See also ACTIVATED CARBON
CHARCOAL
MOLECULAR SIEVES
SILICA GEL
Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report, 14:31164 (R;US)
Efficiency
Restoring solvent for nuclear separation processes, 14:30444 (J;US)
Uranium recovery from seawater by adsorption, 14:31446 (J;US)

ADSORPTION
Dynamics
Comment on "Kinetics of random sequential adsorption", 14:32806 (J;US)
Mathematical Models
An orthogonal collocation approach to modeling multicomponent adsorption in carbon beds, 14:32037 (R;US)
Radon generation, adsorption, absorption, and transport in porous media, 14:31062 (R;US)

AERIAL SURVEYING
Errors
A review of aerial radiological surveys of Nevada Test Site fallout fields 1951 through 1970, 14:31984 (R;US)

AEROSOLS
See also SMOKES
Air Pollution Monitoring
Annual report on establishment and operation of the eastern fine-particle and visibility network, 14:31958 (R;US)
Detection
The LBL/AGMEF/JSU El Yunque Environmental Research Initiative, 14:31933 (R;US)
Fluorescence
Methods for detection of fused alumina powder, used as a tracer aerosol, on air sample filters, 14:31587 (R;GB)
Light Scattering
Blue moons and large fires, 14:31980 (J;US)
Particle Size
Real-time measurement of the size fractionation of aerosol black carbon during the South Coast Air Quality Study, June 13–September 4, 1987, Claremont College, Claremont, California: Final report: Revision, 14:31930 (R;US)
Thermoluminescence
Methods for detection of fused alumina powder, used as a tracer aerosol, on air sample filters, 14:31587 (R;GB)
Trajectories
Aerosol particle deposition in numerically simulated channel flow, 14:32532 (J;US)
Transport
Blue moons and large fires, 14:31980 (J;US)

AFLATOXIN
Chromatography
Separations of compounds of biological and environmental interest by micellar electrokinetic capillary chromatography, 14:31443 (J;US)

AGE ESTIMATION
Isotope Applications
Geochronology and geochemistry by nuclear tracks method: some utilization examples in geologic applied, 14:32412 (R;BR;In Portuguese)

AGRICULTURE
Electric-Powered Vehicles
New methods for the covering of the energy demand of agriculture. Mobile electric operation, 14:31131 (R;NO;In Norwegian)
Environmental Impacts
Isotopes and agriculture, 14:32358 (R;BR;In Portuguese)
Geothermal Process Heat
Industrial applications, 14:30782 (RA;US)
Outages
Farm losses resulting from electric service interruption, 14:31132 (R;CA)
Power Demand
The role of electricity in Pacific Northwest irrigated agriculture: Volume 2, Background materials and support documents: Sections A–C, 14:31107 (R;US)
The role of electricity in Pacific Northwest irrigated agriculture: Volume 2, Background materials and support documents: Sections D–G, 14:31108 (R;US)
Temperature Dependence
Introduction to background materials for Workshop No. 1: Global climate change and its effects on California, 14:31971 (R;US)

AIDS
Computerized Tomography
Neuroradiological changes in AIDS, 14:32337 (RA;DD;In German)
Nmr Imaging
Neuroradiological changes in AIDS, 14:32337 (RA;DD;In German)

AIR
Kerma
Calculation on free-in-air kermas and effective dose equivalents from radioisotopes deposited on soil, 14:32767 (RA;AT)
Quantitative Chemical Analysis
Capillary gas chromatographic separation of alkyl nitrates and peroxycarboxylic nitric anhydrides, 14:31411 (J;US)
Radon 222
Measurement techniques for the estimation of the Rn-222 concentration and the exhalation rate indoors and outdoors using an activated carbon bed, 14:31826 (RA;AT)

AIR CLEANING SYSTEMS
Barrierless ultrasonic air cleaner. Final report, 14:31913 (R;US)

AIR CONDITIONING
Desiccants
Development and field test of a desiccant-based air conditioning system for supermarkets. Final report, October 1983-May 1988, 14:31073 (R;US)
Energy Efficiency
Experience with chilled water storage in a water table aquifer, 14:30938 (RA;CA;In English and French)
Optimization
Analysis of air-conditioning system with chilled-water storage in aquifer, 14:30949 (RA;CA;In English and French)

AIR POLLUTION
See also INDOOR AIR POLLUTION

Contribution of atmospheric nitrate deposition to nitrate loading in the Chesapeake Bay. Final report, 14:32045 (R;US)
National Acid Precipitation Assessment Program (NAPAP): pollutant emission inventories available on tape inventories. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31965 (R;US)

Atmospheric Precipitations
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)

Biological Effects
Analysis of dispersion and deposition of acidifying and phytotoxic air pollutants, 14:31928 (R;DE;In German)

Computer Calculations
Environmental aspects. Development of a computer model for environmental impact of energy production, 14:32002 (R;DK;In Danish)

Dictionaries
Vocabulary of acid precipitation and air pollution. Terminology bulletin 175, 14:31970 (R;CA;In English and French)

Federal Republic Of Germany
Analysis of dispersion and deposition of acidifying and phytotoxic air pollutants, 14:31928 (R;DE;In German)

Forecasting
Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985, 14:30799 (R;US)
Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988, 14:30800 (R;US)

Global Aspects
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)
The changing atmosphere. Implications for global security. Conference statement, 14:30978 (R;CA;In English and French)

Long-Range Transport
Acid precipitation in Ontario study, annual program report, 1987/1988, 14:31935 (R;CA)

Mathematical Models
Validation testing of new mechanisms with outdoor chamber data. Volume 3: calculation of photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31941 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 4: appendixes to photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31942 (R;US)

Meetings
The changing atmosphere. Implications for global security. Conference statement, 14:30978 (R;CA;In English and French)

Photochemical Oxidants
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)

AIR POLLUTION ABATEMENT
Case-Hoyt/Rochester Corporation printing waste heat recovery project. Final report, 14:31125 (R;US)

Catalytic Converters
Evaluation of a resistively heated metal-monolith catalytic converter on a gasoline-fueled vehicle. Technical report, 14:31160 (R;US)

AIR POLLUTION CONTROL
Evaluation of the secondary effects of air stripping, 14:32044 (R;US)

Pollution Control Equipment
Barrierless ultrasonic air cleaner. Final report, 14:31913 (R;US)

Technology Assessment
Iodine emission from separations processes and flowsheets for improved emission control, 14:30562 (R;US)

AIR POLLUTION MONITORS

Comparative Evaluations
Validation testing of new mechanisms with outdoor chamber data, 14:31938 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 1: comparison of CB4 and CAL mechanisms. Final report, April 1986-September 1988, 14:31939 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)

Quality Assurance
Quality-assurance audits of the EPA (Environmental Protection Agency) state-operated precipitation-collection network: 1987, 14:31950 (R;US)

AIR QUALITY

Monitoring
Adequacy of forestry data in assessing the impact of ozone: A national perspective, 14:31921 (R;US)
Annual site environmental report for calendar year 1988, United States Department of Energy, Kansas City Plant, Kansas City, Missouri, 14:31927 (R;US)
PREPP [Process Experimental Pilot Plant] rotary kiln plant performance overview, 14:30540 (R;US)

AIR SAMPLERS

Performance
Capillary gas chromatographic separation of alkyl nitrates and peroxycarboxylic nitric anhydrides, 14:31411 (J;US)

AIR SOURCE HEAT PUMPS

Monitoring
Monitoring of a heat pump heat recovery system, 14:31055 (R;CA)

AIR TRANSPORT

Environmental Impacts
Preventing depletion of stratospheric ozone: Implications on future aircraft emissions, 14:31973 (R;US)

AIR-WATER INTERACTIONS
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)

AIRBORNE PARTICLES
See PARTICULATES

AIRBORNE PARTICULATES
See PARTICULATES

AIRCRAFT

Accidents
An analysis of severe air transport accidents, 14:30597 (R;US)

AIRCRAFT ACCIDENTS
See ACCIDENTS

AIRGLOW

Magnetic Storms
Review of airglow observations at equatorial and low-latitudes in the Brazilian sector, 14:32476 (RA;BR)

Measuring Instruments
Review of airglow observations at equatorial and low-latitudes in the Brazilian sector, 14:32476 (RA;BR)

Southern Hemisphere
Review of airglow observations at equatorial and low-latitudes in the Brazilian sector, 14:32476 (RA;BR)

ALABAMA

Air Conditioning
Experience with chilled water storage in a water table aquifer, 14:30938 (RA;CA;In English and French)

ALARA

Historical Aspects
Twenty-five years of alara, 14:32381 (RA;AT)

ALARM DOSEMETERS
See RADIATION MONITORS

ALASKA

Military Facilities
Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988, 14:31988 (R;US)

Water Resources
Fiscal Year 1987 program report: Alaska Water Research Center, 14:32075 (R;US)

ALBERTA
Acid Rain
The present and potential effects of acidic and acidifying air pollutants on Alberta's environment. Summary report, 14:31923 (R;CA)
Demonstration Programs
Some energy-saving measures for commercial buildings, 14:31054 (R;CA)
Natural Gas Deposits
Alberta gas reserve trends, 14:30315 (R;CA)
Natural Gas Industry
Gas supply and transportation services inquiry, 14:30318 (R;CA)
Property Rights
Surface rights board, sixteenth annual report, 14:31002 (R;CA)
Research Programs
Alberta Research Council [research reports], 14:30372 (R;CA)
Test Facilities
Design operating manual for heavy oil miniplant, 14:30416 (R;CA)

ALBUMEN
See ALBUMINS

ALBUMINS
Electrophoresis
Indirect fluorometric detection in gel electrophysics, 14:31404 (J;US)
Ultrafiltration
Stefan-Maxwell analysis of protein transport in porous membranes, 14:31437 (J;US)

ALCOHOLS
See also ETHANOL
GLYCEROL
GLYCOLS
PROPANOLS
Adsorption
Preferential adsorption and selective permeation of alcohol/hydrocarbon mixtures in reverse osmosis, 14:31430 (J;US)
Dehydration
The use of diffuse reflectance infrared spectroscopy for studies of molecular sieve catalysis, 14:31415 (J;US)
Structural Chemical Analysis
Glassy carbons from poly(furfuryl alcohol) copolymers: structural studies by high-resolution solid-state NMR techniques, 14:31511 (J;US)

ALDEHYDES
See also DEOXYRIBOSE
FORMALDEHYDE
GLUCOSE
XYLOSE
Atmospheric Chemistry
Atmospheric chemistry of aldehydes: enhanced peroxyacetyl nitrate formation from ethanol-fueled vehicular emissions, 14:31978 (J;US)
Chemical Reactions
Fluorometric measurement of aqueous ammonium ion in a flow injection system, 14:31405 (J;US)

ALDEHYDO ACIDS
See ALDEHYDES
CARBOXYLIC ACIDS

ALKALI METALS
See also CESIUM
LITHIUM
POTASSIUM
SODIUM
Ecr Heating
The production of beams from solid materials at the LBL ECR source, 14:31758 (R;US)
Reduction
Metal-ammonia reduction of α-tetralone. Competition between ring reduction, carbonyl reduction, and dimer formation, 14:31495 (J;US)
Separation Processes
Novel bifunctional resins in metal ion separations: ion exchange/coordination resins and ion exchange/precipitation resins, 14:31445 (J;US)
Solvent Extraction
Crown ethers as solvent extraction reagents: where do we stand?, 14:31413 (J;US)

ALKANES
See also DODECANE
ETHANE
HEXANE
METHANE
PROPANE
Chemical Reactions
Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)
Crystal Structure
Crystal structures of $(MeC_5H_4)_4U_2(\mu\text{-}NR)_2$. Unsymmetrical bridging, R = Ph, and symmetrical bridging, R = $SiMe_3$, organoimide ligands in organoactinide compounds, 14:31578 (J;US)
Reactivity
Observation of reactive o-quinodimethanes by flow NMR, 14:31536 (J;US)
Solvent Properties
Reverse micelle supercritical fluid separations, 14:31452 (J;US)

ALKANOIC ACIDS
See CARBOXYLIC ACIDS

ALKENES
See also CYCLOALKENES
HEXENES
PROPYLENE
Chemical Preparation
Characterisation of novel matrix catalysts and catalyst selectivity control for alpha olefin synthesis on the basis of CO and H/sub 2/, 14:30264 (R;DE;In German)

ALKENOIC ACIDS
See CARBOXYLIC ACIDS

ALKINES
See ALKYNES

ALKYLATES
See ALCOHOLS

ALKYNES
Chemical Reactions
Temperature dependence of the rate constants of the reactions of OH radicals with C_2H_2 and C_2D_2 at 1 atm in Ar and from 333 to 1273 K, 14:31528 (J;US)

ALLOY NUCLEAR FUELS
Fbr Type Reactors
Uranium alloys for using in fast breeder reactors, 14:31189 (R;BR;In Portuguese)

ALLOY-1915
See ALUMINIUM BASE ALLOYS

ALLOY-214X
See ALUMINIUM BASE ALLOYS

ALLOY-50KH4N6G12F2V
See CHROMIUM ALLOYS

ALLOY-79NM
See NICKEL BASE ALLOYS

ALLOY-CK-20
See STEEL-CR25NI20

ALLOY-GE
See COPPER ALLOYS
SILVER ALLOYS

ALLOY-GMR-235
See NICKEL BASE ALLOYS

ALLOY-HD-8077
See NICKEL BASE ALLOYS

ALLOY-KH20N80T
See NICKEL BASE ALLOYS

ALLOY-KHN77TYU
See NICKEL BASE ALLOYS

ALLOY-M-252
See NICKEL BASE ALLOYS

ALLOY-MA-754
See NICKEL BASE ALLOYS

ALLOY-MA-956
See IRON BASE ALLOYS

ALLOY-MM-0011
See NICKEL BASE ALLOYS

ALLOY-WAZ-16
See NICKEL BASE ALLOYS

ALLOY-ZR98SN-4
Plasticity
Plastic behaviour of zircoloy-4 sheets in function of the temperature, 14:31210 (R;BR;In Spanish)
Sheets
Plastic behaviour of zircoloy-4 sheets in function of the temperature, 14:31210 (R;BR;In Spanish)
Temperature Dependence
Influences of deformation velocity and temperature on localized deformation of zircaloy-4 in tensile tests, 14:31209 (R;BR;In Portuguese)
Plastic behaviour of zircoloy-4 sheets in function of the temperature, 14:31210 (R;BR;In Spanish)
Tensile Properties
Influences of deformation velocity and temperature on localized deformation of zircaloy-4 in tensile tests, 14:31209 (R;BR;In Portuguese)

ALLOYS
See also ALUMINIUM ALLOYS
BERYLLIUM ALLOYS
CADMIUM ALLOYS
CHROMIUM ALLOYS
COBALT ALLOYS
COPPER ALLOYS
GALLIUM ALLOYS
GERMANIUM ALLOYS
GOLD ALLOYS
HAFNIUM ALLOYS
HEAT RESISTING ALLOYS
IRON ALLOYS
LITHIUM ALLOYS
MAGNESIUM ALLOYS
MERCURY ALLOYS
MOLYBDENUM ALLOYS
NICKEL ALLOYS
NIOBIUM ALLOYS
SILICON ALLOYS
SILVER ALLOYS
TITANIUM ALLOYS
TUNGSTEN ALLOYS
VANADIUM ALLOYS
ZINC ALLOYS
ZIRCONIUM ALLOYS
Micro-alloying of steels. February 1977-April 1989 (Citations from the COMPENDEX data base). Report for February 1977-April 1989, 14:31223 (R;US)
Corrosion
Microbial corrosion: 1988 workshop proceedings, 14:30865 (R;US)
Physical Radiation Effects
Radiation effects on metals, alloys and cement, 14:31213 (R;BR)
Radiation effects on metals, alloys and cement, 14:31200 (RA;BR)
Specifications
Explanations on nomenclature and number of material for steels in accordance with DIN norm - (Deutsch Industrie Norm), 14:31197 (R;BR;In Portuguese)
Standardized Terminology
Explanations on nomenclature and number of material for steels in accordance with DIN norm - (Deutsch Industrie Norm), 14:31197 (R;BR;In Portuguese)

ALPHA BEAMS
Uranium
M-subshell ionization of U by light ion bombardment, 14:32499 (RA;BR)

ALPHA REACTIONS
Angular Distribution
Processes of inelastic collision of composite particles with non-spherical nuclei, 14:32736 (R;SU;In Russian)
Breakup Reactions
Processes of inelastic collision of composite particles with non-spherical nuclei, 14:32736 (R;SU;In Russian)
Elastic Scattering
Study on the /sup 3/H + α and /sup 3/He + α elastic scatterings in a state with zero orbital moment, 14:32734 (R;SU)

ALPHA SPECTROSCOPY
Isotope Dilution
Trace uranium analysis in geological sample by isotope dilution-alpha spectrometry and comparison with other techniques, 14:31391 (R;BR;In Portuguese)

ALPHA-BEARING WASTES
Acid Hydrolysis
Development and active demonstration of acid digestion of plutonium-bearing waste, 14:30483 (RA;US)
Radioactive Waste Processing
Evaluation of treatment alternatives for wastes from both spent fuel rod consolidation and miscellaneous commercial activities, 14:30473 (RA;US)
PREPP [Process Experimental Pilot Plant] rotary kiln plant performance overview, 14:30540 (R;US)
Transport
The use of a thermal probe to determine the effective thermal conductivity of packaging contents, 14:30587 (R;US)
Underground Disposal
Leach testing of simulated Hanford Waste Vitrification Plant reference glass HW-39, 14:30573 (R;US)
Preliminary plan for disposal-system characterization and long-term performance evaluation of the Waste Isolation Pilot Plant, 14:30590 (R;US)

ALUMINATES
Thermal Conductivity
Effects of fast neutron irradiation on thermal conductivity of Li_2O and $LiAlO_2$, 14:32915 (R;US)

ALUMINIA
See ALUMINIUM OXIDES

ALUMINIUM
Electron-Phonon Coupling
Excitons in GaAs-Ga/sub 1-x/Al/sub x/As quantum wells, 14:32793 (RA;BR)
Erosion
Erosion of Al and Al/SiC, 14:31269 (R;US)
Extrusion
High temperature mechanical properties and microscopic examination of extruded powder aluminum, 14:31194 (R;US)
Gallium Arsenides
Excitons in GaAs-Ga/sub 1-x/Al/sub x/As quantum wells, 14:32793 (RA;BR)
Membrane Transport
Supported liquid membrane separation of aluminum from copper leaching liquors, 14:31431 (J;US)
Quantity Ratio
Catalyst development for hydrodeoxygenation and dealkylation of lignins for fuels, 14:30735 (RA;US)
Total Cross Sections
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
X Radiation
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)

ALUMINIUM 27 TARGET
Lanthanum 139 Reactions
The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission, 14:32670 (R;US)

Proton Reactions
Peaks in the valley: Searching for resonances in large angle exclusive scattering, 14:32565 (J;US)

ALUMINIUM 31
Nuclear Structure
Studies of the T/sub Z/ = 5/2 nuclei /sup 31/Al and /sup 29/Mg, 14:32661 (R;AU)

ALUMINIUM ALLOYS
See also ALUMINIUM BASE ALLOYS
Corrosion
Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)
Ductility
Effect of chromium on room temperature ductility and fracture mode in Fe/sub 3/Al, 14:31245 (J;US)
Electronic Structure
Surface states on NiAl(110), 14:31262 (J;US)
Grain Boundaries
Experimental studies of the structure of grain boundaries: Progress report, 14:31191 (R;US)
The structure and properties of grain boundaries in B2 ordered alloys: Progress report, 14:31193 (R;US)
Hydrogenation
Amorphization of Zr_3Al by hydrogenation and subsequent electron irradiation, 14:31185 (R;US)
Mechanical Properties
Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988, 14:31175 (R;US)
Phase Studies
Modulating the composition of a metal/oxide interface and using hydrogen as a probe, 14:31244 (J;US)

ALUMINIUM ARSENIDE SOLAR CELLS
Efficiency
Research on tandem solar cells. Volume 1. Final report. Volume 2. Appendices. Report for 15 May 1984-1 August 1985, 14:30707 (R;US)

ALUMINIUM ARSENIDES
Energy-Level Transitions
Saturation of intersubband transitions in *p*-type semiconductor quantum wells, 14:32812 (J;US)
Reflectivity
Interference effects probed by photoreflectance spectroscopy, 14:31352 (J;US)

ALUMINIUM BASE ALLOYS
Mechanical Properties
Lithium depletion in precipitate free zones (PFZ's) in Al-Li base alloys, 14:31239 (J;US)

ALUMINIUM CHLORIDES
Catalytic Effects
Bimetallic promotion of cooperative hydrogen transfer and heteroatom removal in coal liquefaction: Quarterly technical progress report, December 1, 1988–February 28, 1989, 14:30263 (R;US)

ALUMINIUM COMPOUNDS
See also ALUMINATES
ALUMINIUM ARSENIDES
ALUMINIUM CHLORIDES
ALUMINIUM NITRIDES
ALUMINIUM OXIDES
Chemical Vapor Deposition
Chemically amplified laser direct-writing of aluminum, 14:31341 (BA;US)
Crystal Structure
Crystal structure of aluminum molybdate, $Al_2(MoO_4)_3$, determined by time-of-flight powder neutron diffraction, 14:31295 (J;US)

ALUMINIUM IONS
Gain
Measurements of gain and line broadening in lithiumlike aluminum, 14:32895 (J;US)
Photoionization
Photoionization of Al^+ ions: a relativistic random phase approximation study, 14:32486 (R;US)
Population Inversion
Measurements of gain and line broadening in lithiumlike aluminum, 14:32895 (J;US)

ALUMINIUM NITRIDES
Structural Chemical Analysis
Microanalytical and structural characterization of optical materials by electron microscopy and related spectroscopies, 14:31283 (R;US)

ALUMINIUM OXIDES
Air Samplers
Methods for detection of fused alumina powder, used as a tracer aerosol, on air sample filters, 14:31587 (R;GB)
Catalytic Effects
CO isotopic exchange reaction over Rh/Al_2O_3: nondissociative exchange on metallic Rh sites, 14:31529 (J;US)
Cavitation
Characterization of pore evolution in ceramics during creep failure and densification, 14:31277 (R;US)
Chemical Properties
Physico-chemical properties of supported and unsupported γ-Al_2O_3 and TiO_2 ceramic membranes, 14:31432 (J;US)
Coking
Infrared study of carbon on alumina, 14:31182 (R;US)
Deactivation
Infrared study of carbon deposits on bimetallic catalysts: Final report, September 1, 1986–August 31, 1989, 14:31467 (R;US)
Defects
Characterization of processing flaws in beta alumina, 14:31291 (BA;US)
Dielectric Properties
Dielectric measurements of selected ceramic materials at 245 ghz, 14:31267 (R;US)
Filters
Methods for detection of fused alumina powder, used as a tracer aerosol, on air sample filters, 14:31587 (R;GB)
Fractography
Beta alumina failures in sodium/sulfur batteries, 14:30969 (BA;US)
Mechanical Properties
Characterization and fundamental studies on CuO sorbent materials to determine attrition mechanisms on substrate gamma alumina: Technical progress report No. 9, September 23, 1988–December 23, 1988, 14:30804 (R;US)
Neutron Diffraction
Application of neutron diffraction to the measurement of internal residual strain in the constituents of advanced composites, 14:31316 (R;US)
Nmr Spectra
Experimental and kinetic modeling of acid/base and redox reaction over oxide catalysts: Annual report, 14:31276 (R;US)
Particulates
Health-hazard evaluation determination report No. 76-33-431, 76-34-431, Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia, 14:31944 (R;US)
Sintering
Studies of synthesis, crystallography and sintering of β-aluminas: Final report, April 15, 1976–April 15, 1977, 14:31279 (R;US)
Solid State Lasers
Development of an efficient high-brightness $Ti:Al_2O_3$ laser amplifier. Final report, 15 August 1987-14 February 1988, 14:31626 (R;US)
Sorptive Properties
Restoring solvent for nuclear separation processes, 14:30444 (J;US)
Structural Chemical Analysis
Microanalytical and structural characterization of optical materials by electron microscopy and related spectroscopies, 14:31283 (R;US)

ALUMINUM
See ALUMINIUM

ALVEOLI (PULMONARY)
See LUNGS

AMALGAMS
See MERCURY ALLOYS

AMBERLITE
See ORGANIC ION EXCHANGERS
AMERICIUM
Solvent Extraction
Recovery of plutonium and americium from chloride salt wastes by solvent extraction, 14:30431 (J;US)
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)
Thermodynamic modeling of chemical equilibria in metal extraction, 14:31420 (J;US)
AMERICIUM 241
Radionuclide Kinetics
United States transuranium registry: Annual report, 1 October 1987–30 September 1988, 14:32372 (R;US)
Scintillation Counting
Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent extraction-liquid scintillation count method, 14:31805 (R;CN;In Chinese)
Solvent Extraction
Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent extraction-liquid scintillation count method, 14:31805 (R;CN;In Chinese)
AMERICIUM ISOTOPES
See also AMERICIUM 241
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
AMIDES
See also ACRYLAMIDE
Band Theory
Polarons in acetanilide, 14:31375 (J;US)
Polarons
Polarons in acetanilide, 14:31375 (J;US)
Solvent Properties
Potentiality of nonorganophosphorus extractants in chemical separations of actinides, 14:30443 (J;US)
AMINES
See also BENZIDINE
DOPAMINE
NITROSAMINES
OXIMES
PIPERIDINES
POLYCYCLIC AROMATIC AMINES
PYRROLIDINES
RHODAMINES
Chromatography
Separations of compounds of biological and environmental interest by micellar electrokinetic capillary chromatography, 14:31443 (J;US)
Denitration
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
AMINO ACID SEQUENCE
Biological Evolution
Role of protein folding in the evolution of protein sequences, 14:32131 (BA;US)
AMINO ACIDS
See also AMINOBUTYRIC ACID
ARGININE
CDTA
EDTA
HEDTA
LYSINE
Biological Pathways
β Turns in early evolution: chirality, genetic code, and biosynthetic pathways, 14:32118 (BA;US)
Biosynthesis
Prebiotic synthesis: problems and challenges, 14:32081 (BA;US)
Isotachophoresis
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
Mass Spectroscopy
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
AMINO ALCOHOLS
See ALCOHOLS
AMINES
AMINO SUGARS
See AMINES
AMINOBUTYRIC ACID
Receptors
3- and 5-isoxazolol zwitterions: a model of interaction with the GABA-A receptor relating to agonism and antagonism, 14:32189 (BA;US)
AMINOGLYCIDES
See AMINES
AMMONIA
Ecological Concentration
Dutch priority programme on acidification: Summary report, Acidification research, 1984–1988, 14:31969 (R;NL)
Measuring Methods
Measuring ammonia content in flue gas, 14:30807 (R;DK;In Danish)
Reduction
Metal-ammonia reduction of α-tetralone. Competition between ring reduction, carbonyl reduction, and dimer formation, 14:31495 (J;US)
Removal
Study of ammonia removal in coal gasification processes: Final report, 14:30249 (R;US)
Separation Processes
Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)
AMMONIUM COMPOUNDS
Adsorption
Surfactant loss: Effects of temperature, salinity, and wettability, 14:30292 (R;US)
Fluorescence Spectroscopy
Fluorometric measurement of aqueous ammonium ion in a flow injection system, 14:31405 (J;US)
Isotachophoresis
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
Mass Spectroscopy
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
AMPLIFIERS
See also MICROWAVE AMPLIFIERS
Assessment of a novel r-f linac amplifier concept. Final report, June 1987-July 1988, 14:31711 (R;US)
Development of an efficient high-brightness Ti:Al_2O_3 laser amplifier. Final report, 15 August 1987-14 February 1988, 14:31626 (R;US)
ANAEROBIC DIGESTION
Methane from partially digested sewage sludge. Final report, 14:30651 (R;US)
Mathematical Models
Modeling of Brettanomyces clausenii growth on mixtures of glucose and cellobiose, 14:30712 (RA;US)
ANALYSIS (ACTIVATION)
See ACTIVATION ANALYSIS
ANALYSIS (QUANTITATIVE CHEMICAL)
See QUANTITATIVE CHEMICAL ANALYSIS
ANALYSIS (THERMAL)
See THERMAL ANALYSIS
ANGIOGRAPHY
See BIOMEDICAL RADIOGRAPHY
BLOOD VESSELS
ANGRA-1 REACTOR
Primary Coolant Circuits
Transient performance of flow in circuits of PWR type reactors, 14:30837 (R;BR;In Portuguese)

Pumps
Transient performance of flow in circuits of PWR type reactors, 14:30837 (R;BR;In Portuguese)

ANHYDRIDES
Gas Chromatography
Capillary gas chromatographic separation of alkyl nitrates and peroxycarboxylic nitric anhydrides, 14:31411 (J;US)

ANIMAL CELLS
Origin
Origin of cells: a symbiosis between genes, catalysts, and membranes, 14:32159 (BA;US)
Radiosensitivity
Genetic and biochemical basis of radiation sensitivity in cultured human and other mammalian cells, 14:32373 (RA;IL)

ANIMAL FEEDS
Contamination
Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)

ANIMAL GROWTH
Inhibition
Identification of a non-specific inhibitor of [methyl^{3}H]thymidine incorporation into DNA of normal and pre-neoplastic cells, 14:32211 (R;US)

ANIMAL SHELTERS
Energy Management Systems
Microprocessor environmental control in a large farrowing complex, 14:31117 (R;CA)

ANIMAL TISSUES
See also BONE MARROW
Multi-Element Analysis
Sequential determination of biological and pollutant elements in marine bivalves, 14:31460 (J;US)

ANIONS
See also HYDROGEN IONS 1 MINUS
Electronic Structure
Infrared spectrum of $F^- \times H_2O$, 14:31534 (J;US)
Hydration
Viewing the born model for ion hydration through a microscope, 14:31476 (BA;US)

ANL
Information Systems
ANL site response for the DOE FY1991 information technology resources long-range plan, 14:32981 (R;US)
Research Programs
Evaluation of advanced lead-acid batteries developed for load-leveling applications, 14:30966 (BA;US)

ANNULAR CORE PULSE REACTOR
See ACPR REACTOR

ANNULAR CORE RESEARCH REACTOR
See ACPR REACTOR

ANODES
Design
Reliability of Li/SO/sub 2/ cells for long life applications, 14:30963 (BA;US)
Materials Testing
Influence of electrolyte density on response of LiCl, 14:30968 (BA;US)

ANSTO
Research Programs
Program of research 1988-89, 14:32971 (R;AU)

ANTENNAS
See also RADIO TELESCOPES
Recent improvements to the model for wire antennas in the code NEC [Numerical Electromagnetics Code], 14:31879 (R;US)
Mathematical Models
Numerical modeling of monopoles on radial-wire ground screens, 14:31878 (R;US)
Performance
Pyramidal horns: Part 2, A novel design method for horns of any desired gain and aperture phase error, 14:31868 (R;US)

ANTHRACENE
Nuclear Magnetic Resonance
Dissolving metal reduction of aceanthrylene and NMR analysis of a rigid, boat-shaped 9,10-dihydroanthracene, 14:31484 (J;US)

ANTHRACITE
Sorptive Properties
Carbonaceous solids as a model for adsorption by dispersion forces, 14:31516 (J;US)

ANTI-B NEUTRAL MESONS
Hadronic Particle Decay
Search for $b \rightarrow u$ transitions in exclusive hadronic B-meson decays, 14:32573 (J;US)
Spectroscopy
Prospects for B physics spectroscopy in Fermilab fixed target experiments, 14:32556 (J;US)

ANTI-MISSILE SYSTEMS
See SPACE WEAPONS

ANTI-SATELLITE SYSTEMS
See SPACE WEAPONS

ANTIBODIES
See also MONOCLONAL ANTIBODIES
Biochemical Reaction Kinetics
Catalytic antibodies, 14:32088 (BA;US)
Chemical Properties
Antibody catalysis by transition state stabilization, 14:32089 (BA;US)
Genetic Engineering
Engineering of antibodies with a known three-dimensional structure, 14:32090 (BA;US)

ANTIFERROMAGNETIC MATERIALS
Heisenberg Model
Theory of the spin liquid state of the Heisenberg antiferromagnet, 14:31371 (J;US)
Mathematical Models
Phase diagram of the Hubbard model: A variational wavefunction approach, 14:32808 (J;US)

ANTIKAONS
Bound State
KK^- molecules, 14:32597 (J;US)

ANTIMUONS
See MUONS PLUS

ANTINEUTRINO-ELECTRON INTERACTIONS
Elastic Scattering
Determination of $\sin^2\theta_W$ from measurements of differential cross sections for muon-neutrino and -antineutrino scattering by electrons, 14:32569 (J;US)

ANTIPARTICLES
See also ANTIKAONS
Conversion
Constraints on muonium-antimuonium conversion, 14:32605 (J;US)

AORTA
Nmr Imaging
NMR imaging of thoracic aortic dissection, 14:32280 (RA;DD;In German)
Ruptures
NMR imaging of thoracic aortic dissection, 14:32280 (RA;DD;In German)

APPALACHIA
Coal Miners
Pneumoconiosis in Appalachian bituminous coal miners, 14:30284 (R;US)

APPLIANCES
See also WATER HEATERS
WOOD BURNING APPLIANCES
Energy Efficiency
Market study of commercial appliances: Volume 1, Assessment of commercial appliance efficiency improvements: Final report, 14:31059 (R;US)

AQUACULTURE
Environmental Effects
Farming of rainbow trout in acidified waters. Environmental effects and production prospects, 14:32359 (R;SE;In Swedish)
Geothermal Process Heat
Aquaculture, 14:30781 (RA;US)
Productivity
Farming of rainbow trout in acidified waters. Environmental effects and production prospects, 14:32359 (R;SE;In Swedish)

Trout
Farming of rainbow trout in acidified waters. Environmental effects and production prospects, 14:32359 (R;SE;In Swedish)

AQUATIC ECOSYSTEMS
See also WETLANDS

Biological Recovery
Recovery processes in marine ecosystems, 14:32397 (R;SE)

AQUEOUS HUMOR
See EYES

AQUICULTURE
See AQUACULTURE

AQUIFERS

Cold Recovery
Analysis of air-conditioning system with chilled-water storage in aquifer, 14:30949 (RA;CA;In English and French)
Economical effect of the introduction of aquifer cold preservation for air-conditioning and temperature lowering of Shanghai Hongqido Airport, 14:30952 (RA;CA;In English and French)
Experience with chilled water storage in a water table aquifer, 14:30938 (RA;CA;In English and French)
Research on energy storage in the underground water and its quality in Changzhou city, 14:30955 (RA;CA;In English and French)

Heat Recovery
Short-term aquifer thermal energy storage (ATES) test cycles, 14:30946 (RA;CA;In English and French)

Heat Storage
Potential for seasonal storage of industrial surplus heat, 14:30939 (RA;CA;In English and French)
Project of thermal storage in deep aquifer (Sarcelles, France). Technical data and economic analysis, 14:30940 (RA;CA;In English and French)
The Danish aquifer thermalenergy storage program, 14:30944 (RA;CA;In English and French)

Isotope Applications
Use of isotope techniques to investigate saltwater intruded aquifers in the Philippines, 14:32062 (RA;XA)

Isotope Ratio
Application of stable isotopes to hydrogeology in coal mine, 14:32063 (RA;XA)

Limestone
Low-temperature heat storage at Risoe. Pilot project, 14:30960 (R;DK;In Danish)

Permeability
Permeability of Ironton-Galesville sandstone at elevated temperature and pressure, 14:30941 (RA;CA;In English and French)

Plumes
Monitoring of hot water plume movements in an aquifer with borhole/surface resistivity measurements, 14:30764 (RA;CA;In English and French)

Pressure Effects
Permeability of Ironton-Galesville sandstone at elevated temperature and pressure, 14:30941 (RA;CA;In English and French)

Seasonal Thermal Energy Storage
A computer code for analyzing the performance of aquifer thermal energy storage systems, 14:30951 (RA;CA;In English and French)
Aquifer thermal energy storage experience with the Scarborough field trial, 14:30957 (RA;CA;In English and French)
Aquifer thermal energy storage experimental project in Italy, 14:30937 (RA;CA;In English and French)
Aquifer thermal energy storage in the United States, 14:30945 (RA;CA;In English and French)
Brunkeberg aquifer thermal storage in central Stockholm, 14:30935 (RA;CA;In English and French)
Groundwater heat pumps in combination with low-temperature natural heat sources. Economical and technical aspects, 14:30953 (RA;CA;In English and French)
Heat storage and heat pumps on aquifer. Two case studies, 14:30931 (RA;CA;In English and French)
Heating of an office building using solar energy in combination with a heat pump and seasonal heat storage, 14:30950 (RA;CA;In English and French)
Low temperature thermal aquifer storage. A full scale experiment with the purpose of avoiding long term cooling of the subsurface environment, 14:30934 (RA;CA;In English and French)
Project for low-temperature storage of solar heat in Klippan, Sweden, 14:30959 (RA;CA;In English and French)
Project of thermal storage in deep aquifer (Sarcelles, France). Simulation of the hydraulic and thermal behaviour of the system, 14:30958 (RA;CA;In English and French)
The feasibility of seasonal storage of excess heat for the district heating system at Almere, 14:30954 (RA;CA;In English and French)

Sensible Heat Storage
Aquifer thermal energy storage systems with two aquifers, 14:30929 (RA;CA;In English and French)
Comparison of long-term aquifer thermal energy storage experiments to 3-D computer simulations, 14:30930 (RA;CA;In English and French)
Design and implementation of a heated water injection experiment in an unconsolidated aquifer, 14:30956 (RA;CA;In English and French)
Investigation of the vertical flow aquifer thermal energy storage concept and numerical simulation of the Dorigny field experiment, 14:30936 (RA;CA;In English and French)
Monitoring of hot water plume movements in an aquifer with borhole/surface resistivity measurements, 14:30764 (RA;CA;In English and French)
Short-term aquifer thermal energy storage (ATES) test cycles, 14:30946 (RA;CA;In English and French)
Underground heat storage in France. Present stage development and future prospects, 14:30948 (RA;CA;In English and French)

Temperature Effects
Permeability of Ironton-Galesville sandstone at elevated temperature and pressure, 14:30941 (RA;CA;In English and French)

Water Chemistry
Research on energy storage in the underground water and its quality in Changzhou city, 14:30955 (RA;CA;In English and French)

ARC WELDING
See also SUBMERGED ARC WELDING

Metallurgical Flux
Viscosity effects in selected flux cored arc welding consumables, 14:31338 (R;CA)

ARCTIC REGIONS

Paleoclimatology
Holocene proxy-climate data from the Canadian Arctic, 14:32413 (R;CA)

Waste Disposal
Sewage waste discharge to the arctic marine environment, 14:32047 (R;CA)

AREA POLLUTION SOURCES
See POLLUTION SOURCES

ARGININE

Chemical Reactions
Guanidyl groups: new metal-binding ligands in biomolecules. Reactions of chloro(2,2':6',2"-terpyridine)platinum(II) with arginine in two cytochromes c and with other guanidyl ligands, 14:31505 (J;US)

ARGON

Charged-Particle Transport
Electron degradation and yields of initial products: V. Degradation spectra, the ionization yield, and the Fano factor for argon under electron irradiation, 14:32755 (J;US)

Intermolecular Forces
Spectroscopic mapping of the OH-Ar van der Waals potential, 14:31519 (J;US)

Isotope Dating
Pre-cambrian geochronology in Rio Grande do Norte, Brazil, 14:32416 (R;BR;In Portuguese)

ARGONNE NATIONAL LABORATORY
See ANL

ARMS CONTROL
Defense Nuclear Agency Fiscal Year 1990/91 program document: research, development, test and evaluation, defense agencies (supports congressional budget estimates), 14:31168 (R;US)

Legal Aspects
Legal aspects of implementing a global chemical weapons convention under domestic laws, 14:31169 (R;US)

Political Aspects
International Atomic Energy Aagency safeguards: observations on lessons for verifying a chemical weapons convention, 14:31171 (R;CA)
PACOM net assessment: Pakistani and Indian nuclear perceptions. Volume 1. Main report. Final report, 31 January-31 August 1983, 14:31170 (R;US)

Verification
Ensuring effective monitoring technology for arms control verification: Final report, 14:31172 (R;US)
International Atomic Energy Aagency safeguards: observations on lessons for verifying a chemical weapons convention, 14:31171 (R;CA)

AROMATIC ACIDS
See CARBOXYLIC ACIDS

AROMATIC COMPOUNDS
See AROMATICS

AROMATICS
See also BENZENE
BENZIDINE
CONDENSED AROMATICS
PHENOLS
POLYCYCLIC AROMATIC HYDROCARBONS
QUINONES
TETRALIN

Chemical Bonds
Columnar homoconjugation, 14:31482 (J;US)

Chemical Reactions
Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)

Chromatography
Separations of compounds of biological and environmental interest by micellar electrokinetic capillary chromatography, 14:31443 (J;US)

Crystal Structure
Crystal structures of $(MeC_5H_4)_4U_2(\mu\text{-}NR)_2$. Unsymmetrical bridging, R = Ph, and symmetrical bridging, R = $SiMe_3$, organoimide ligands in organoactinide compounds, 14:31578 (J;US)

Reactivity
Observation of reactive o-quinodimethanes by flow NMR, 14:31536 (J;US)

Reduction
Metal-ammonia reduction of α-tetralone. Competition between ring reduction, carbonyl reduction, and dimer formation, 14:31495 (J;US)

ARRAY PROCESSORS
QLISP for parallel processors. Final report, 15 July 1986-31 July 1988, 14:32974 (R;US)
Supercomputers for solving PDE problems. Final report, 1 October 1985-31 March 1988, 14:32980 (R;US)

Design
A simple microprocessor for FASTBUS slave modules, 14:33014 (J;US)

Programming
Beta operation: a parallel primitive. Doctoral thesis, 14:32977 (R;US)

Uses
A simple microprocessor for FASTBUS slave modules, 14:33014 (J;US)

ARSENIC
Gallium
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)

Indium
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)

Quaternary Alloy Systems
Contribution to the study of zinc and cadmium diffusions in InP and In/sub 0,97/ Ga/sub 0,03/ As/sub 0,08/ P/sub 0,92/ quaternary compound, 14:31199 (R;BR;In Portuguese)

Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)

Superlattices
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)

ARTIFICIAL INTELLIGENCE
Expert-system approach to large space-systems control. Technical report, September 1987-October 1988, 14:31891 (R;US)

ASBESTOS
Dusts
Health-hazard evaluation determination report No. 75-121-281, Penn Central Transportation Company, Philadelphia, Pennsylvania, 14:31946 (R;US)

Health Hazards
Asbestos exposure: health effects. January 1985-April 1989 (Citations from the Biobusiness data base). Report for January 1985-April 1989, 14:32400 (R;US)

Removal
Asbestos exposure: health effects. January 1985-April 1989 (Citations from the Biobusiness data base). Report for January 1985-April 1989, 14:32400 (R;US)

ASH SEPARATORS
See INERTIAL SEPARATORS

ASHES
See also FLY ASH

Chemical Composition
Utilization potential of circulating fluidized bed combustion residue in construction applications. Final report, 14:30272 (R;CA)

Sorptive Properties
Self-desulphurating characteristics of high sulfur oil shale in fluidized bed combustor, 14:30399 (RA;CN)

Waste Disposal
Development of critical life stage assays: Teratogenic effects of ash basin effluent components on freshwater fish, gambusia affinis and daphnia: Progress report, 21 May 1988–1 June 1989, 14:30275 (R;US)

ASPERGILLUS
Gene Regulation
Targeted modifications to the structure of Trichoderma reesei CBHII, 14:30727 (RA;US)

ASTRA REACTOR
Occupational Exposure
Reducing radiation doses at a 10MW research reactor, 14:30892 (RA;AT)

ASTRONAUTS
Radiation Hazards
Astronaut radiation exposure in low-earth orbit. Part 1. Galactic cosmic radiation, 14:32366 (R;US)
Contributions to the plenary meeting of cospar (Committee on Space Research) (27th) held in Helsinki, Finland 18-29 July 1988, 14:32365 (R;US)

ASTRONOMY
See also GAMMA ASTRONOMY

Meetings
Decade of UV astronomy with the IUE satellite. Volume 1. Proceedings of a celebratory symposium, 14:32446 (R;FR)

Research Programs
Corporate plan 1989, 14:32970 (R;GB)
Ground based plan. A plan for research in astronomy and planetary science by ground based techniques, 14:32454 (R;GB)

United Kingdom
Corporate plan 1989, 14:32970 (R;GB)
Ground based plan. A plan for research in astronomy and planetary science by ground based techniques, 14:32454 (R;GB)

ASTROPHYSICS
Meetings
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)

Technology Transfer
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)

ATF TORSATRON
Plasma Instability
Equilibrium and ideal stability studies for ATF, 14:32863 (R;US)
Magnetic fluctuations due to pressure driven instabilities in ATF, 14:32862 (R;US)

ATMOSPHERIC CHEMISTRY
The Argonne low level ^{14}C counting system, 14:31905 (R;US)
Modifications
Beyond CO_2: The other greenhouse gases, 14:31972 (R;US)
Climate projections with regional resolution, 14:31976 (R;US)
Cloud albedo, greenhouse effects, atmospheric chemistry, and climate change, 14:31975 (R;US)
Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint, 14:31974 (R;US)
Preventing depletion of stratospheric ozone: Implications on future aircraft emissions, 14:31973 (R;US)
The LBL/AGMEF/JSU El Yunque Environmental Research Initiative, 14:31933 (R;US)
Monitoring
The MAP3S Precipitation Chemistry Network: Data and quality control summary for 1986 and 1987, 14:31968 (R;US)

ATMOSPHERIC CIRCULATION
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)

ATMOSPHERIC EXPLOSIONS
See also STARFISH EVENT
Electromagnetic Fields
Neutron and gamma transport in air by TRIPOLI-2 time dependent energy deposition and electron current calculation, 14:32982 (R;FR)

ATMOSPHERIC PRECIPITATIONS
See also SNOW
Air Pollution
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)
Chemical Composition
The MAP3S Precipitation Chemistry Network: Data and quality control summary for 1986 and 1987, 14:31968 (R;US)
Global Aspects
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)
Northern Hemisphere
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)

ATOM COLLISIONS
See also ION-ATOM COLLISIONS
PHOTON-ATOM COLLISIONS
Bibliographies
International bulletin on atomic and molecular data for fusion. No. 38, 14:32873 (R;XA)
Charge Exchange
Recoil distributions in particle transfer, 14:32518 (J;US)

ATOMIC ABSORPTION SPECTROSCOPY
See ABSORPTION SPECTROSCOPY

ATOMIC BEAMS
Beam Production
Focusing of particle beams using two-stage laser ablation, 14:32517 (J;US)
Focusing
Focusing of particle beams using two-stage laser ablation, 14:32517 (J;US)

ATOMIC BOMBS
See NUCLEAR WEAPONS

ATOMIC CLOUDS
See RADIOACTIVE CLOUDS

ATOMIC ENERGY
See NUCLEAR ENERGY

ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS

ATOMIC IONS
Ground States
Energy levels and transition probabilities in the ground-state configuration of sulfur-like ions, 14:32514 (J;US)

ATOMIC MODELS
Eigenvalues
On two variants of solving the eigenvalue problem for a system of second-order differential equations in the method of many-dimensional angular coulomb functions, 14:32504 (RA;SU;In Russian)

ATOMIC PHYSICS
Research Programs
Energy and Technology Review, February–March 1989, 14:32508 (R;US)

ATOMIC SHELLS
See ELECTRONIC STRUCTURE

ATOMIC SHELLS (M)
See M SHELL

ATOMIC WEAPONS
See NUCLEAR WEAPONS

ATOMIZATION
Mathematical Models
Attempts at modelling the processes of gas- and water-atomization for the production of metal powders, 14:31198 (R;DE;In German)

ATOMS
Energy Levels
Lossless propagation of optical pulses through *N*-level systems with Gell-Mann symmetry, 14:32847 (J;US)
Excited States
Cesium laser-excited optical filter, 14:31643 (BA;US)
Trapping
R-f spectroscopy of trapped neutral atoms, 14:32487 (R;US)

ATP
Enzymatic Hydrolysis
Involvement of cryptic ATPase activity of UvrB and its proteolysis product, UvrB* in DNA repair, 14:32202 (J;GB)

ATP-ASE
Biochemical Reaction Kinetics
Implications for enzymic catalysis from free-energy reaction coordinate profiles, 14:32142 (BA;US)
Involvement of cryptic ATPase activity of UvrB and its proteolysis product, UvrB* in DNA repair, 14:32202 (J;GB)

ATTENUATION
Concretes
Shielding of low-energy cyclotrons, 14:31700 (RA;AT;In German)

ATTITUDES OF THE PUBLIC
See PUBLIC OPINION

AUGER EFFECT
Meetings
[Symposium on the Auger Effect, Paris, Orsay, and Limeil, France, March 29–30, 1989 and April 3–7 and 20–21, 1989]: Foreign trip report, 14:32492 (R;US)

AUGER ELECTRON SPECTROSCOPY
Technology Assessment
Quantitation of Auger and X-ray photoelectron spectroscopies, 14:31464 (J;US)

AURORAE
Electrons
Auroral electron accelerator. Manifestation of a universal ion/wave/electron interaction, 14:32479 (R;GB)
Plasma Waves
Auroral electron accelerator. Manifestation of a universal ion/wave/electron interaction, 14:32479 (R;GB)

AURORAL ZONES
Electron Density
Electron-density depletions in the nightside auroral zone. Progress report, 14:32477 (R;US)

AUSTENITIC STEELS
See also STEEL-CR17NI12MO3
STEEL-CR18NI9
STEEL-CR19NI10
STEEL-CR25NI20
Corrosion
Progress in the assessment of the corrosion of low and intermediate level waste containers under repository conditions, 14:31218 (R;GB)
Pipes
Integrity of austenitic stainless steel piping welds for nuclear service, 14:30869 (R;BR)
Stainless Steels
Ductile crack growth in nuclear austenitic stainless steel plates: influence of crack orientation and steel microstructure, 14:31205 (R;BR)
Stress Corrosion
Proceedings: 1986 workshop on advanced high-strength materials, 14:30821 (R;US)
Welded Joints
Integrity of austenitic stainless steel piping welds for nuclear service, 14:30869 (R;BR)
AUSTRALIA
Oil Shale Processing Plants
Upgrading Julia Creek shale oil - syncrude or fully refined products, 14:30363 (RA;CN)
Research Programs
Status of oil shale developments and supporting research in Australia, 14:30324 (RA;CN)
AUSTRIA
Radiometric Surveys
Measurements of the Research Centre Seibersdorf with regard to the reactor accident at Chernobyl, 14:32015 (RA;AT)
AUSTRIAN RESEARCH REACTOR
See ASTRA REACTOR
AUSTRIAN TRIGA-MARK-II REACTOR
See TRIGA-2-VIENNA REACTOR
AUTOCLAVES
Design
Design and testing of an autoclave system for lignin hydrotreating, 14:30737 (RA;US)
AUTOMATION
Implementation
Office Automation Plan, 14:30535 (R;US)
AUTOMOTIVE FUELS
Production
New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)
AUTONOMIC NERVOUS SYSTEM
Computerized Tomography
Abdominal sympathetic tumours complex CT diagnosis, 14:32305 (RA;DD)
CT-controlled lumbar sympathectomy in treatment of occlusive arterial disease, 14:32304 (RA;DD;In German)
Neoplasms
Abdominal sympathetic tumours complex CT diagnosis, 14:32305 (RA;DD)
Surgery
CT-controlled lumbar sympathectomy in treatment of occlusive arterial disease, 14:32304 (RA;DD;In German)
AZO COMPOUNDS
Binding Energy
Electron donor-acceptor properties of porphyrins, phthalocyanines, and related ring chelates: a molecular orbit approach, 14:31540 (J;US)

B

B MESONS
See also B MINUS MESONS
B NEUTRAL MESONS
Hadronic Particle Decay
Angular correlations in the decay $B \rightarrow VV$ and CP violation, 14:32626 (J;US)
Semileptonic Decay
Mass ratio m/sub c//m/sub b/ in semi-leptonic b-decays, 14:32593 (J;NL)
Weak Hadronic Decay
SU(3) predictions for nonleptonic B-meson decays, 14:32627 (J;US)
B MINUS MESONS
Hadronic Particle Decay
Search for $b \rightarrow u$ transitions in exclusive hadronic B-meson decays, 14:32573 (J;US)
B NEUTRAL MESONS
See also ANTI-B NEUTRAL MESONS
Quantum Chromodynamics
QCD effects in the B^0-B^{-0} system, 14:32610 (J;US)
Spectroscopy
Prospects for B physics spectroscopy in Fermilab fixed target experiments, 14:32556 (J;US)
BACTERIA
See also ESCHERICHIA COLI
RHODOPSEUDOMONAS
RHODOSPIRILLUM
Biological Evolution
Prokaryotes and archaebacteria are not monophyletic: rate invariant analysis of rRNA genes indicates that eukaryotes and eocytes form a monophyletic taxon, 14:32161 (BA;US)
Role directional mutation pressure in the evolution of the eubacterial genetic code, 14:32157 (BA;US)
Cellulolytic Activity
The role of proteolytic enzymes in degradation of plant tissues: Summary report, 14:30704 (R;US)
Gene Regulation
Engineering of antibodies with a known three-dimensional structure, 14:32090 (BA;US)
Growth
Optimization of cellulase productivity from Acidothermus cellulolyticus, 14:30725 (RA;US)
Purification and partial characterization of two endoglucanases from Acidothermus cellulolyticus, 14:30722 (RA;US)
Thermostable cellulase enzymes from Acidothermus cellulolyticus: studies with growth media activities, 14:30721 (RA;US)
BACTERIOPHAGES
Biological Evolution
Evolution of the RNA coliphages: the role of secondary structures during RNA replication, 14:32108 (BA;US)
Genetic Mapping
Family of autocatalytic group I introns in bacteriophage T4, 14:32205 (BA;US)
BAG MODEL
Mass Formulae
Hyperon resonances in the chiral bag model, 14:32612 (J;US)
BAGHOUSES
Efficiency
Magnetohydrodynamics Coal-Fired Flow Facility: Quarterly technical progress report, October–December 1988, 14:31041 (R;US)
BALLASTS
Comparative Evaluations
Comparative performance of fluorescent iron-core ballasts and electronic ballasts, 14:31076 (R;CA;In English and French)
BALLISTIC MISSILE DEFENSE
Computerized Control Systems
Expert-system approach to large space-systems control. Technical report, September 1987-October 1988, 14:31891 (R;US)
BANKS
See COMMERCIAL BUILDINGS
BARC
Progress Report
BARC annual report 1987, 14:32964 (R;IN)
BARIUM
Copper
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)

Electron-Atom Collisions
Problems associated with the measurement of coherence parameters: Superelastic electron scattering by laser-excited $^{138}Ba(...6s6p\ ^1P_1)$ atoms, 14:32522 (J;US)
Separation Processes
Novel bifunctional resins in metal ion separations: ion exchange/coordination resins and ion exchange/precipitation resins, 14:31445 (J;US)
Superconductors
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Yttrium Oxides
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)

BARIUM CHLORIDES
Compressibility
Filtration behavior of slurries with varying compressibilities, 14:31456 (J;US)

BARIUM COMPOUNDS
See also BARIUM CHLORIDES
BARIUM FLUORIDES
BARIUM OXIDES
BARIUM SULFATES
Crystal-Phase Transformations
Structural phase transformations and superconductivity in $La_{2-x}Ba_xCuO_4$, 14:31303 (J;US)
Cuprates
Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988, 14:31266 (R;US)
Electron Spin Resonance
Electron paramagnetic resonance in the orthorhombic and tetragonal phases of YBa/sub 2/Cu/sub 3/O/sub x/, 14:32795 (R;BR;In Portuguese)
Electronic Structure
Photoemission spectroscopy of single crystal HTSC materials: A Fermi liquid electronic structure, 14:31393 (R;US)
Microstructure
The study of structure-processing-property relations in copper oxide-based high T_c superconductors: Progress report, July 1, 1988–March 1, 1989, 14:31278 (R;US)
Titanates
High-brightness diode lasers for blue-green applications. Interim technical report, 1 July 1987-31 December 1988, 14:31627 (R;US)

BARIUM FLUORIDES
Layers
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)
P-N Junctions
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)
Substrates
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)

BARIUM OXIDES
Chemical Vapor Deposition
Chemical vapor deposition of $YBa_2Cu_3O_{7-x}$ superconducting films, 14:31296 (J;US)
Compacting
Observation of crystallographic texture and J/sub c/ anisotropy in bulk shock-compacted YBa/sub 2/Cu/sub 3/O/sub 7-x/ powders, 14:31297 (J;US)
Crystal Structure
X-ray study of in-plane epitaxy of $YBa_2Cu_3O_x$ thin films, 14:31311 (J;US)
Electric Conductivity
Fluctuation conductivity of Tl-Ba-Ca-Cu-O thin films, 14:31310 (J;US)
Electrodynamics
Nonlinear electrodynamics in the granular superconductor $YBa_2Cu_3O_7$: Experiments and interpretation, 14:31307 (J;US)
Magnetization
Flux creep in $Y(Gd)Ba_2Cu_3O_{7-\delta}$: Magnetic field dependence, 14:31306 (J;US)
Phonons
High-energy oxygen phonon modes and superconductivity in $Ba_{1-x}K_xBiO_3$: An inelastic-neutron-scattering experiment and molecular-dynamics simulation, 14:31302 (J;US)
Physical Properties
Preparation and Raman analysis of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$, 14:31312 (J;US)
Specific Heat
Low-temperature specific heat of single-crystal $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$, 14:31313 (J;US)
Superconductivity
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
X-Ray Spectra
Distorted chain sites for Co- and Fe-substituted $YBa_2Cu_3O_{7-\delta}$, 14:31308 (J;US)

BARIUM SULFATES
Precipitation
Novel bifunctional resins in metal ion separations: ion exchange/coordination resins and ion exchange/precipitation resins, 14:31445 (J;US)

BARSTOW SOLAR PILOT PLANT
Reliability
16th inter-ram conference for the electric power industry, 14:30752 (R;US)

BARYON NUMBER 2 RESONANCES
See DIBARYONS

BARYON RESONANCES
See BARYONS

BARYONS
See also DIBARYONS
Mass Spectra
Parity doubling in baryons and its relevance to hadronic structure, 14:32620 (J;US)
The world according to lattice QCD, 14:32636 (J;US)

BASALT
Comparative Evaluations
Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass, 14:30604 (R;SE)
Corrosion
Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass, 14:30604 (R;SE)

BATTELLE PACIFIC NORTHWEST LABORATORIES
Research Programs
Pacific Northwest Laboratory annual report for 1988 to the DOE Office of Energy Research: Part 3, Atmospheric sciences, 14:31986 (R;US)

BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES

BEAM BENDING MAGNETS
Alignment
Beam-based alignment technique for the SLC [Stanford Linear Collider] linac, 14:31776 (R;US)
Beam Optics
Rollfix—An adiabatic roll transition for the SLC [Stanford Linear Collider] Arcs, 14:31723 (R;US)
Design
Concepts, features, and design of a sixteen-to-four beam combiner for ILSE [Induction Linac Systems Experiment], 14:32924 (R;US)
Design calculations and measurements of a dipole magnet with Permendur pole pieces, 14:31775 (R;US)
Magnetic Field Configurations
Effect of the fringing field in sector bending magnets: the coupling of the transverse planes in the solutions of the equation of motion at second-order, 14:32880 (R;FR)

BEAM BUNCHING
Rf Systems
Gridded buncher - far field extension using carbon coated teflon/sub R/ sleeves, 14:31862 (R;AU)

BEAM DUMPS
Beam dumps, stoppers and Faraday cups at the SLC, 14:31781 (R;US)
BEAM DYNAMICS
See also BEAM BUNCHING
Beam Monitoring
Precision measurements of the SLC [Stanford Linear Collider] beam energy, 14:31778 (R;US)
Precision synchrotron radiation detectors, 14:31777 (R;US)
Computerized Simulation
Vertically integrated simulation tools for self-consistent tracking and analysis, 14:31721 (R;US)
Hamilton-Jacobi Equations
Beam dynamics with the Hamilton-Jacobi equation, 14:31728 (R;US)
Mapping
Construction of symplectic full-turn maps by application of an arbitrary tracking code, 14:31727 (R;US)
BEAM FOCUSING MAGNETS
Design
Tentative design of beam focusing for the AHF linac and transport systems, 14:31757 (R;US)
BEAM INJECTION
See also NEUTRAL ATOM BEAM INJECTION
Fluctuations
Filamentation of phase space and coherent noise for beams injected into storage rings, 14:31740 (R;DE)
BEAM MONITORING
Analog-To-Digital Converters
Stable current-to-frequency converter for charged particle beam monitoring, 14:31751 (R;SU;In Russian)
BEAM MONITORS
See also FARADAY CUPS
Frequency Response Testing
Time and frequency response of beam position monitors at the Los Alamos proton storage ring, 14:31756 (R;US)
BEAM OPTICS
Design
The optical design of the spin manipulation system for the SLAC Linear Collider, 14:31726 (R;US)
BEAM POSITION
Beam Monitoring
Precision synchrotron radiation detectors, 14:31777 (R;US)
BEAM PROFILES
Compton Spectrometers
Influence of the beam aperture on the Compton line profile, 14:32501 (RA;BR)
BEAM TRANSPORT
Electrostatic Lenses
Fine focusing of intense heavy ions for the production of hot dense matter, 14:31739 (R;DE;In German)
Modifications
Improvements to a transmission-line model of a main-ring cavity, 14:31752 (R;US)
Nonlinear Problems
A general formalism for quasi-local correction of multipole distortions in periodic transport systems, 14:31759 (R;US)
BEAM WIDTHS
See BEAM PROFILES
BEAUFORT SEA
Density
Salinity, temperature and density data for the Canadian Beaufort Sea shelf, March 1988, 14:32439 (R;CA)
Offshore Platforms
Beaufort Sea artificial island erosion data, 14:30303 (R;CA)
Salinity
Salinity, temperature and density data for the Canadian Beaufort Sea shelf, March 1988, 14:32439 (R;CA)
Temperature Distribution
Salinity, temperature and density data for the Canadian Beaufort Sea shelf, March 1988, 14:32439 (R;CA)
BENZENE
Mass Spectroscopy
Mass and energy selective ion partitioning in a two-section Fourier transform ion cyclotron resonance spectrometer cell, 14:31398 (J;US)
BENZIDINE
Dyes
Industrial-hygiene survey, Bachmeier and Company, Kearny, New Jersey, November 4-8, 1985, 14:31952 (R;US)
BENZOPHENONE
Photoelectron Spectroscopy
Photoelectron spectroscopy of biologically active molecules. XVI. Benzophenone derivatives, 14:31397 (BA;US)
Photolysis
Interaction of halide and pseudohalide ions with triplet benzophenone-4-carboxylate: kinetics and radical yields, 14:31559 (J;US)
BENZOPYRENE
Absorption Spectra
Molecular absorption measurements by FT/UV-Vis spectrometry, 14:31883 (J;US)
Metabolic Activation
Fluorescence line narrowing spectrometric analysis of benzo[a]pyrene-DNA adducts formed by one-electron oxidation, 14:32402 (J;US)
BER-2 REACTOR
Modifications
Radiation protection aspects of rebuilding the Berlin research reactor (Ber 2), 14:30893 (RA;AT;In German)
BERKELIUM ISOTOPES
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
BERL SADDLES
See COLUMN PACKING
BERLIN-2 RESEARCH REACTOR
See BER-2 REACTOR
BERYLLIA
See BERYLLIUM OXIDES
BERYLLIUM
Dusts
Health-hazard evaluation determination report No. 75-87-280, Kawecki Berylco Industries, Inc., Reading, PA, 14:31943 (R;US)
BERYLLIUM 7
Ecological Concentration
Sources and areal distribution of trace metals in recent sediments of Middle Loch, Pearl Harbor (Hawaii), 14:32038 (R;US)
BERYLLIUM 9 TARGET
Photonuclear Reactions
Observation of $\Sigma_c^0 \rightarrow \Lambda_c^+ \pi^-$ decays, 14:32572 (J;US)
Proton Reactions
High-resolution measurement of massive-dielectron production in 800-GeV proton-beryllium collisions, 14:32579 (J;US)
Threshold behavior of electron pair production in *p*-Be collisions, 14:32659 (J;US)
BERYLLIUM ALLOYS
Magnetic Properties
Muon spin rotation in the magnetic and superconducting ground states of (U,Th)Be_{13} and (U,Th)Pt_3, 14:31252 (J;US)
Superconductivity
Muon spin rotation in the magnetic and superconducting ground states of (U,Th)Be_{13} and (U,Th)Pt_3, 14:31252 (J;US)
BERYLLIUM HYDRIDES
Absorption Spectra
Algebraic approach to molecular electronic spectra. I. Energy levels, 14:32509 (J;US)

BERYLLIUM MODERATORS
See BERYLLIUM
BERYLLIUM OXIDES
Dielectric Properties
Dielectric measurements of selected ceramic materials at 245 ghz, 14:31267 (R;US)
BETA BACKSCATTERING GAGES
See RADIOMETRIC GAGES
BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS
BETA BEAMS (POSITRONS)
See POSITRON BEAMS
BETA SPECTROMETERS
Microchannel Electron Multipliers
Position-sensitive detector for local plane of the beta-spectrometer, 14:31822 (R;SU;In Russian)
Position Sensitive Detectors
Position-sensitive detector for local plane of the beta-spectrometer, 14:31822 (R;SU;In Russian)
BETA-MINUS DECAY
Mass Formulae
Study of beta decay energies and atomic masses, 14:32673 (R;SE)
BETA-PLUS DECAY
Study of beta decay energies and atomic masses, 14:32673 (R;SE)
BHABHA ATOMIC RESEARCH CENTER
See BARC
BIBLIOGRAPHIES
Yucca Mountain Project bibliography, July–December 1988: An update: Civilian Radioactive Waste Management Program, 14:30529 (R;US)
BIKINI
Nuclear Explosions
Bikini accident and Chernobyl accident, 14:32389 (RA;AT)
BILE DUCTS
See BILIARY TRACT
BILIARY TRACT
Calculi
Importance of CT and MR in extracorporeal cholelithotripsy, 14:32226 (RA;DD;In German)
Computerized Tomography
CT-cholegraphy, 14:32227 (RA;DD)
BINARY ALLOY SYSTEMS
Phase Studies
Grain-boundary ordering, segregation, and melting transitions in a two-dimensional lattice-gas model, 14:32809 (J;US)
BINARY MIXTURES
Dehydration
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
Phase Diagrams
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
BINDERS
Nmr Imaging
Development of magnetic resonance imaging technology for imaging binder distribution in ceramics, 14:31272 (R;US)
Spatial Distribution
Development of magnetic resonance imaging technology for imaging binder distribution in ceramics, 14:31272 (R;US)
BIOCENOSES
See ECOSYSTEMS
BIOCONVERSION
See also ANAEROBIC DIGESTION
FERMENTATION
Economics
Xylose fermentation analysis, 14:30668 (RA;US)
Research Programs
Ethanol from lignocellulose: the DOE/SERI Biochemical Conversion/Alcohol Fuels Program, 14:30655 (RA;US)
Overview of enzymatic hydrolysis research, 14:30663 (RA;US)
BIOGAS
See METHANE
BIOGEOCENOSES
See ECOSYSTEMS
BIOLOGICAL DOSEMETERS
Radiation Accidents
Estimation of DNA synthesis in lymphocyte as biological indicator in radiation accidents. Final report for the period 1 November 1986 - 30 November 1988, 14:32758 (R;XA)
BIOLOGICAL EVOLUTION
Earliest phylogenetic branchings: comparing rRNA-based evolutionary trees inferred with various techniques, 14:32160 (BA;US)
Exon theory of genes, 14:32168 (BA;US)
Globins: a case study in molecular phylogeny, 14:32166 (BA;US)
Origin of cells: a symbiosis between genes, catalysts, and membranes, 14:32159 (BA;US)
Prebiotic synthesis: problems and challenges, 14:32081 (BA;US)
Protein architecture and the origin of introns, 14:32170 (BA;US)
Reconstruction of phylogenetic trees and estimation of divergence times under estimation of evolution, 14:32162 (BA;US)
Which organic compounds could have occurred on the prebiotic earth?, 14:32080 (BA;US)
Errors
Genetic error and genome design, 14:32154 (BA;US)
Reliability
Reliability of evolutionary trees, 14:32163 (BA;US)
BIOLOGICAL PATHWAYS
Evaluation
Following macromolecular interactions and sugar metabolism using site specific ^{3}H labelling and NMR spectroscopy, 14:32210 (R;US)
BIOLOGICAL RADIATION EFFECTS
See also RADIATION INJURIES
Information
Medical consequences of a nuclear plant accident, 14:30925 (R;SE;In Swedish)
BIOLOGICAL REACTORS
See BIOREACTORS
BIOLOGICAL SHIELDING
Licensing
Calculation of requirements respectively of radiation protection as condition for the permission of medical X-ray plants, 14:30649 (RA;AT)
BIOLOGICAL WARFARE AGENTS
Chemical and biological warfare: protection, decontamination, and disposal. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989, 14:31601 (R;US)
BIOMASS
Gasification
Bark gasification at Vaeroe bruk, 14:30742 (R;SE;In Swedish)
Research Programs
Biofuels Program summary: Volume 2, Research summaries, fiscal year 1988, 14:30703 (R;US)
Biofuels program summary: Volume 1, Overview fiscal year 1988, 14:30702 (R;US)
Proceedings of the 6th Canadian bioenergy research and development seminar, 14:31040 (R;CA)
BIOMEDICAL RADIOGRAPHY
See also FLUOROSCOPY
Contrast Media
Angiography of hemodialysis access devices with low osmolality contrast media, technique and results, 14:32277 (RA;DD)
Digital Systems
Computed radiography with laser-stimulated luminescence, 14:32324 (RA;DD)
Digital radiography today - state of the art, 14:32272 (RA;DD)
Digital-image archiving systems in diagnostic radiology: picture-archiving and communication systems. January 1975-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-April 1989, 14:32353 (R;US)
Laser Radiation
Computed radiography with laser-stimulated luminescence, 14:32324 (RA;DD)

BIOPSY
Computerized Tomography
Indication and accuracy of CT-aided biopsy of the brain, 14:32240 (RA;DD;In German)
BIOREACTORS
Comparative Evaluations
Enhancement of cellulase production of Trichoderma reesei in fluidized bed reactor, 14:30724 (RA;US)
Design
Packed bed hydrodynamics of an acid hydrolysis percolation reactor, 14:30659 (RA;US)
Efficiency
Fermentability tests of sugars produced in the Solar Energy Research Institute's plug-flow reactor, 14:30658 (RA;US)
Performance Testing
Experimental studies of the progressing batch reactor, 14:30710 (RA;US)
BIPHENYLDIAMINE
See BENZIDINE
BIPYRIDINES
Structural Chemical Analysis
Raman and surface-enhanced Raman study of asymmetrically substituted viologens, 14:31542 (J;US)
Vibrational spectra and normal-coordinate analysis of tris(bipyridine)ruthenium(II), 14:31522 (J;US)
BISMUTH
Electronic Structure
Electronic and structural properties of a discommensurate monolayer system: GaAs(110)-(1×1)Bi, 14:31377 (J;US)
Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)
BISMUTH 209 TARGET
Triton Reactions
Electromagnetic decay of 10/sup +/ states and yrast isomers in /sup 208/Pb, 14:32682 (J;NL)
BISMUTH ADDITIONS
Thermodynamic Properties
Electrocatalysis of anodic oxygen-transfer reactions at doped lead dioxide, 14:31051 (BA;US)
BISMUTH OXIDES
Microstructure
Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)
Phonons
High-energy oxygen phonon modes and superconductivity in $Ba_{1-x}K_xBiO_3$: An inelastic-neutron-scattering experiment and molecular-dynamics simulation, 14:31302 (J;US)
Specific Heat
Low-temperature specific heat of single-crystal $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$, 14:31313 (J;US)
Specific heat of $Bi_2Sr_2CuO_6$ and $Bi_2Sr_2CaCu_2O_8$ in the superconducting state, 14:31309 (J;US)
Superconductivity
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)
BITTER SPAR
See DOLOMITE
BITUMENS
Chemical Reactions
The numerical simulation of forward combustion in a tube reactor using the Sunnyside resource, 14:30369 (R;US)
Desulfurization
Concentration and removal of nitrogen and sulfur containing compounds from organic liquids phases using electrochemically reversed chemical complexation, 14:30268 (J;US)
Dissolution
Heats of dissolution of tar sand bitumen in various solvents, 14:30392 (R;US)
Separation Processes
Alberta Research Council [research reports], 14:30371 (R;CA)
Structural Chemical Analysis
Characterization of flash pyrolysis products from Green River shale, 14:30347 (RA;CN)
BITUMINOUS COAL
Biodegradation
Biothermochemical conversion of a bituminous coal, 14:30245 (R;US)
Gasification
Thermally initiated carbon-carbon bond-cleavage reactions occurring during coal gasification. Final report, April 1985-June 1988, 14:30265 (R;US)
BLADES (TURBINES)
See TURBINE BLADES
BLANKETS (BREEDING)
See BREEDING BLANKETS
BLASTING
See EXPLOSIVE FRACTURING
BLASTS
See EXPLOSIONS
BLOOD CLOTTING
See BLOOD COAGULATION
BLOOD COAGULATION
Biological Evolution
Exon and domain evolution in the proenzymes of blood coagulation and fibrinolysis, 14:32171 (BA;US)
Reconstructing the evolution of vertebrate blood coagulation from a consideration of the amino acid sequences of clotting proteins, 14:32165 (BA;US)
BLOOD SERUM
Quantitative Chemical Analysis
Determination of selenium metabolites in biological fluids using instrumental and molecular neutron activation analysis, 14:31459 (J;US)
BLOOD VESSELS
Biomedical Radiography
Angiography of hemodialysis access devices with low osmolality contrast media, technique and results, 14:32277 (RA;DD)
Malformations
Importance of the complex radiological diagnosis for the decision on therapeutical treatment of malformations of cerebral blood vessels, 14:32333 (RA;DD;In German)
BLUE-GREEN ALGAE
See CYANOBACTERIA
BNL
Research Programs
Brookhaven Highlights, October 1, 1987–September 30, 1988, 14:30986 (R;US)
Environmental Chemistry Division: Annual report, 1988, 14:31916 (R;US)
Technology Transfer
Brookhaven National Laboratory technology transfer five year plan fiscal years 1990-1994, 14:30985 (R;US)
BOILERS
See also FLUIDIZED BED BOILERS
Energy Efficiency
Field testing and monitoring of two high efficiency condensing gas boilers installed in a highrise building, 14:31682 (R;CA)
Thermal Fatigue
Thermal fatigue cracking of Estonian oil-shale-fired boilers' tubes caused by on-load water deslagging, 14:30403 (RA;CN)
BOILING WATER COOLED AND MODERATED REACTOR
See BWR TYPE REACTORS
BOLTZMANN COLLISION INTEGRAL
See BOLTZMANN EQUATION
BOLTZMANN EQUATION
C Codes
Criticality benchmarks for COG: A new point-wise Monte Carlo code, 14:32754 (R;US)
BOLTZMANN TRANSPORT EQUATION
See BOLTZMANN EQUATION
BOLTZMANN-VLASOV EQUATION
Analytical Solution
Equilibrium of a plasma in the fluid- and Vlasov-Maxwell systems, 14:32867 (R;US)

BONE DISEASES
See SKELETAL DISEASES
BONE FRACTURES
Healing
Experimental study on the usefulness of magnetotherapy in bone fractures (tibial osteotomy in the rat). Accumulation of 99 mTc MDP - tests of tensile strength - determination of alkaline phosphatase, 14:32209 (R;DE;In German)
Magnetic Fields
Experimental study on the usefulness of magnetotherapy in bone fractures (tibial osteotomy in the rat). Accumulation of 99 mTc MDP - tests of tensile strength - determination of alkaline phosphatase, 14:32209 (R;DE;In German)
BONE JOINTS
Computerized Tomography
CT in relapsing dislocation of the shoulder joint, 14:32317 (RA;DD;In German)
Native CT of the soft parts of the shoulder, 14:32327 (RA;DD;In German)
Nmr Imaging
Development of the fields of application of NMR imaging and NMR spectroscopy, 14:32340 (RA;DD;In German)
Nmr Spectra
Development of the fields of application of NMR imaging and NMR spectroscopy, 14:32340 (RA;DD;In German)
Skeletal Diseases
CT in relapsing dislocation of the shoulder joint, 14:32317 (RA;DD;In German)
NMR imaging of the knee-joint cartilage using 3D volume imaging combined with a fast computer for image processing, 14:32316 (RA;DD;In German)
BONE MARROW
Transplants
Bone marrow transplantation at Inst. Port. Oncologia - Lisbon (Portugal), 14:32217 (RA;BR;In Portuguese)
BONES
See SKELETON
BONNER SPHERE DETECTORS
Calibration
Calibration and intercomparison of neutron moderation spectrometers, 14:32777 (R;DD)
BOOSTERS (PARTICLE)
See PARTICLE BOOSTERS
BOREHOLES
Closures
Study on sealing of boreholes, 14:30552 (R;FR;In Italian)
Electric Conductivity
An evaluation of cross-borehole resistivity tomography, 14:32423 (R;US)
BORN-GREEN-YVON EQUATION
See BOLTZMANN EQUATION
BORON
Segregation
Experimental studies of the structure of grain boundaries: Progress report, 14:31191 (R;US)
BORON 10 TARGET
Deuteron Reactions
Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)
BORON HYDRIDES
Absorption Spectra
Algebraic approach to molecular electronic spectra. I. Energy levels, 14:32509 (J;US)
BORON NITRIDES
Dielectric Properties
Dielectric measurements of selected ceramic materials at 245 ghz, 14:31267 (R;US)
BORON OXIDES
Crystal Growth
Factors affecting stress distribution and displacements in crystals III-V grown by Czochralski method with liquid encapsulation, 14:31282 (R;BR;In Spanish)
Stresses
Factors affecting stress distribution and displacements in crystals III-V grown by Czochralski method with liquid encapsulation, 14:31282 (R;BR;In Spanish)
BOROSILICATE GLASS
Comparative Evaluations
Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass, 14:30604 (R;SE)
Corrosion
Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass, 14:30604 (R;SE)
Leaching
Solubility interpretation of leach tests, 14:30512 (RA;US)
Performance
Savannah River waste glass performance, 14:30513 (RA;US)
Performance Testing
Characterization of a borosilicate glass incorporating MTR HLW with reference to the underground disposal, 14:30515 (RA;US)
BOROSILICATES
See BOROSILICATE GLASS
BOTTOMONIUM
See also UPSILON-10355 MESONS
UPSILON-10575 MESONS
Particle Production
High-resolution measurement of massive-dielectron production in 800-GeV proton-beryllium collisions, 14:32579 (J;US)
Radiative Decay
Observation of CHI/sub b/ and CHI/sub b/' production in exclusive decays of the Y' and Y" with the CUSB detector at the Cornell e/sup +/e/sup -/ storage ring, 14:32547 (R;DE)
Rest Mass
Observation of CHI/sub b/ and CHI/sub b/' production in exclusive decays of the Y' and Y" with the CUSB detector at the Cornell e/sup +/e/sup -/ storage ring, 14:32547 (R;DE)
BOUNDARIES (GRAIN)
See GRAIN BOUNDARIES
BRACKISH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS
BRAIN
See also CEREBRUM
Aids
Comparison of CT and MRT in intracranial inflammations and infections, 14:32336 (RA;DD;In German)
Blood Circulation
Measurements of regional cerebral blood flow (rCBF) using dynamic single-photon emission computed tomography (DSPECT): Definition of a generally acceptable normal range and follow-up checks after extracranial bypass surgery, 14:32343 (R;DE;In German)
Blood Flow
Measurement of regional cerebral blood flow by intravenous administation of 133 xenon. Theory, technique and clinical applications, 14:32360 (R;SE)
Blood Vessels
Importance of the complex radiological diagnosis for the decision on therapeutical treatment of malformations of cerebral blood vessels, 14:32333 (RA;DD;In German)
Computerized Tomography
Age dependence of subarachnoid spaces as evidenced by CT, 14:32246 (RA;DD;In German)
CT and MRI of the brain, 14:32237 (RA;DD)
CT-aided specimen collection - an alternative to stereotaxic cerebral biopsy, 14:32242 (RA;DD;In German)
Changes of the cerebral computed tomogram in children during cytostatic therapy, 14:32247 (RA;DD;In German)
Comparison of cerebral SPECT with CT in diagnosis of acute cerebrovascular insufficiency, 14:32335 (RA;DD;In German)
Comparison of intraventricular and parenchymal brain hemorrhage in clinical and CT picture, 14:32330 (RA;DD)
Computed tomography of the brain after posttraumatic changes, 14:32245 (RA;DD)

Dynamic computerized tomography of the brain, 14:32334 (RA;DD;In German)
MRT versus CT in tumors of skull base and lower brain stem, 14:32303 (RA;DD;In German)
NMR imaging of intracranial tumors in children as compared with CT, 14:32239 (RA;DD;In German)
What kind of advantages offers MRT compared with CT in imaging spontaneous intracerebral hematomas, 14:32331 (RA;DD;In German)

Hemorrhage
Comparison of intraventricular and parenchymal brain hemorrhage in clinical and CT picture, 14:32330 (RA;DD)
What kind of advantages offers MRT compared with CT in imaging spontaneous intracerebral hematomas, 14:32331 (RA;DD;In German)

Inflammation
Comparison of CT and MRT in intracranial inflammations and infections, 14:32336 (RA;DD;In German)

Ischemia
Comparison of cerebral SPECT with CT in diagnosis of acute cerebrovascular insufficiency, 14:32335 (RA;DD;In German)

Neoplasms
Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)

Nmr Imaging
CT and MRI of the brain, 14:32237 (RA;DD)
Differential diagnosis of white substance alterations by NMR imaging, 14:32243 (RA;DD;In German)
MRT versus CT in tumors of skull base and lower brain stem, 14:32303 (RA;DD;In German)
NMR imaging of intracranial tumors in children as compared with CT, 14:32239 (RA;DD;In German)
Optimization of Magnevist doses in NMR imaging of brain tumors, 14:32338 (RA;DD;In German)
Three-dimensional representation in neuroradiology, 14:32323 (RA;DD;In German)
What kind of advantages offers MRT compared with CT in imaging spontaneous intracerebral hematomas, 14:32331 (RA;DD;In German)

Positron Computed Tomography
Positron emission computed tomography, 14:32354 (BA;US)

Proton Spectra
Methodology and first clinical application of localized proton spectroscopy in cases of brain tumors and ischemic insults, 14:32264 (RA;DD;In German)

Single Photon Emission Computed Tomography
Measurements of regional cerebral blood flow (rCBF) using dynamic single-photon emission computed tomography (DSPECT): Definition of a generally acceptable normal range and follow-up checks after extracranial bypass surgery, 14:32343 (R;DE;In German)

BRASS-ALPHA
Crack Propagation
Stress corrosion cracking and metal-induced embrittlement: Local chemistry and local plasticity: Progress report, September 1, 1986–October 31, 1988, 14:31192 (R;US)

BRASS-BETA
Stress Corrosion
Stress corrosion cracking and metal-induced embrittlement: Local chemistry and local plasticity: Progress report, September 1, 1986–October 31, 1988, 14:31192 (R;US)

BRAZIL
Age Estimation
Pre-cambrian geochronology in Rio Grande do Norte, Brazil, 14:32416 (R;BR;In Portuguese)

Geologic Surveys
Pre-cambrian geochronology in Rio Grande do Norte, Brazil, 14:32416 (R;BR;In Portuguese)

Oil Shale Processing Plants
Development of an oil shale fines pyrolysis technology, 14:30350 (RA;CN)
Oil shale industrialization in Brazil, 14:30367 (RA;CN)

BREAKWATERS
See DAMS

BREASTS
See MAMMARY GLANDS

BREEDING BLANKETS
Ceramics
EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)

Lithium Silicates
Mechanical properties of lithium silicates for fusion reactor breeder blankets, 14:32922 (R;DE;In German)

Magnetohydrodynamics
MHD flow in insulating circular ducts for fusion blankets, 14:32898 (R;US)

BREEDING PELLETS
Fabrication
Fabrication of lithium ceramic pellets, rings and single crystals for irradiation in BEATRIX-II, 14:32927 (R;US)

BREMSSTRAHLUNG (MAGNETIC)
See SYNCHROTRON RADIATION

BRICKS
Waste Product Utilization
Multipurpose use of shale ash and its paragenetic mineral in China, 14:30404 (RA;CN)

BRINES
Isotope Ratio
Origin of the yellow brine and the black brine in Sichuan Basin, 14:32065 (RA;XA)

Waste Disposal
Liner-waste compatibility studies for coal-fired power plants, 14:31112 (R;US)

BRITISH COLUMBIA
Air Pollution Control
An air management strategy for Williams Lake, 14:31915 (R;CA)
Woodwaste incineration and air quality in Williams Lake, 14:31914 (R;CA)

Electric Utilities
B.C. Hydro, annual report, 1988, 14:31006 (R;CA)

Lakes
Recreation opportunities inventory, 14:30678 (R;CA)

Natural Gas Industry
British Columbia Petroleum Corporation annual report, 1987-88, 14:30317 (R;CA)

Offshore Operations
Status of the federal-provincial government response to the West Coast offshore exploration environmental assessment panel report, 14:30302 (R;CA)

Waste Management
The provincial role in municipal solid waste management. A discussion paper, 14:31134 (R;CA)

Water Reservoirs
Recreation opportunities inventory, 14:30678 (R;CA)

BROMINE COMPOUNDS
Photolysis
Interaction of halide and pseudohalide ions with triplet benzophenone-4-carboxylate: kinetics and radical yields, 14:31559 (J;US)

BRONCHI
Computerized Tomography
CT and MRI in the evaluation of bronchogenic carcinoma, 14:32283 (RA;DD)
Detection of isolated bronchoceles by CT, 14:32287 (RA;DD;In German)

Nmr Imaging
CT and MRI in the evaluation of bronchogenic carcinoma, 14:32283 (RA;DD)

Pathological Changes
Detection of isolated bronchoceles by CT, 14:32287 (RA;DD;In German)

BRONCHOGENIC CARCINOMA
See CARCINOMAS
RESPIRATORY SYSTEM DISEASES

BROOKHAVEN AGS
Particle Boosters
A high intensity hadron facility, AGS II, 14:31708 (J;US)

Research Programs
AGS experiments, 1986, 1987, 1988, 14:32542 (R;US)

BROOKHAVEN NATIONAL LABORATORY
See BNL

BROOKHAVEN RHIC
Particle Production
Review of RHIC as a B factory, 14:31709 (J;US)

BUCKLING (STRUCTURAL)
See DEFORMATION

BUILDINGS
See also ANIMAL SHELTERS
COMMERCIAL BUILDINGS
CONTAINMENT BUILDINGS
GREENHOUSES
OFFICE BUILDINGS
PUBLIC BUILDINGS
RESIDENTIAL BUILDINGS

Daylighting
Development of a second-generation, video-based luminance mapper for daylighting research, 14:31091 (R;US)

Energy Audits
Equipment and systems evaluation. Energy performance, 14:31083 (R;CA;In English and French)
Global evaluation. Energy performance, 14:31082 (R;CA;In English and French)
Retrofit evaluation. Energy performance, 14:31090 (R;CA;In English and French)

Energy Consumption
ENCORE-CANADA. Computer program for the study of energy consumption of residential buildings in Canada, 14:31070 (R;CA)

Energy Efficiency
Least-cost planning: profiting from the negawatt revolution, 14:31009 (RA;US)

Energy Management
Building and energy-management systems: a user guide, 14:31067 (R;US)

Energy Storage
Potential benefits of distributed PCM thermal, 14:31068 (R;US)

Evaluation
Environmental and energy performance, 14:31078 (R;CA;In English and French)
Functional performance, 14:31079 (R;CA;In English and French)
Systems and material performance, 14:31080 (R;CA;In English and French)

Heat Transfer
Comprehensive room transfer functions for efficient calculation of the transient heat transfer processes in buildings, 14:31095 (J;US)

Information Dissemination
The development of services for the transfer of technical information on building, 14:33020 (R;CA)

Power Systems
Electrical systems evaluation, 14:31088 (R;CA;In English and French)

Retrofitting
Retrofit evaluation. Energy performance, 14:31090 (R;CA;In English and French)

Seasonal Thermal Energy Storage
Seasonal heating and cooling through aquifer energy storage, 14:30942 (RA;CA;In English and French)

BUILDINGS (CONTAINMENT)
See CONTAINMENT BUILDINGS

BUNCHING (BEAM)
See BEAM BUNCHING

BURNERS
See also OIL BURNERS

Design
Low NO/sub x//SO/sub x/ burner trials. CFB Gagetown, 14:31680 (R;CA)

Pollution Abatement
Low NO/sub x//SO/sub x/ burner trials. CFB Gagetown, 14:31680 (R;CA)

BURNUP
Computer Calculations
Determination of effective cross sections and burnup calculation for HTR-irradiations in a reflector position of the research reactor FRJ-2 (DIDO), 14:30845 (R;DE;In German)

Radiation Hazards
Comparison of analysis methods for burnup credit applications, 14:30588 (R;US)

BUSES
Diesel Fuels
Methanol Bus Program data analysis report. Interim report, September 1987-June 1988, 14:31163 (R;US)
Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988, 14:31098 (R;US)

Financing
Transit management and replacement capital planning. Transportation research record, 14:31101 (R;US)

Methanol Fuels
Methanol Bus Program data analysis report. Interim report, September 1987-June 1988, 14:31163 (R;US)
Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988, 14:31098 (R;US)
Training manual for methanol-fuel use in transit operations, 14:31097 (R;US)

BUTANOIC ACID
See BUTYRIC ACID

BUTYRIC ACID
Biological Effects
Regulation of the rat metallothionein-I gene by sodium butyrate, 14:32199 (J;GB)

BWR TYPE REACTORS
See also GUNDREMMINGEN-2 REACTOR
GUNDREMMINGEN-3 REACTOR
OKG-2 REACTOR
RWE-BAYERNWERK REACTOR
Power ramp irradiation of AA test fuel rods OA1-1,-2,-3,-4 and OL1-1, -4: The Super-Ramp Extension Project, 14:30830 (R;SE)

Fuel Rods
The Studsvik Super-Ramp Extension Project: Ceramography of Asea Atom test fuel rod OL1-1, 14:30832 (R;SE)
The Studsvik Super-Ramp Extension Project: Destructive post-irradiation examinations of rod group PK 1X, 14:30836 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1984–February 28, 1985, 14:30831 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1985–March 31, 1986, 14:30835 (R;SE)

Fuel-Cladding Interactions
The Studsvik Super-Ramp Extension Project: Complementary post-irradiation examinations of KWU/CE rods at Karlstein, 14:30829 (R;SE)
The Studsvik Super-Ramp Extension Project: Non destructive examinations of the PK1X rod and the rod OL1-5, 14:30834 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, March 1, 1985–September 30, 1985, 14:30833 (R;SE)

Occupational Exposure
Occupational exposures and practices in nuclear power plants, 14:30895 (R;US)

Oscillations
Analysis of resonance oscillation of the neutron flow in a BWR-core, 14:30823 (R;SE;In Swedish)

Radioactive Waste Storage
Evaluation of potential benefits of transportable storage casks: Final report, 14:30822 (R;US)

Reactor Safety
Remarks before the Beijing meeting of the pacific basin conference, 14:31003 (J;US)

Stress Corrosion
Proceedings: 1986 workshop on advanced high-strength materials, 14:30821 (R;US)

Water Chemistry
Evaluation of non-radiological water chemistry at power reactors, 14:30824 (R;US)

C

C-1430 RESONANCES
See MESONS

CABLES
See also ELECTRIC CABLES
Evaluation
Evaluation of the IBM token-ring network via the proposed standard wiring plan, 14:33008 (R;US)

CABLES (ELECTRIC)
See ELECTRIC CABLES

CADMIUM
Adsorption
Kinetic studies of cadmium and ferricyanide adsorption on goethite, 14:32048 (J;US)
Chromium
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Magnetic Semiconductors
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Selenium
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Separation Processes
Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)
Sorption
Cadmium and manganese sorption by soil macropore linings and fillings, 14:32005 (J;US)

CADMIUM ALLOYS
Grain Refinement
Effects of multiple reductions on grain refinement during hot working of alloy 718, 14:31225 (R;US)

CADMIUM COMPOUNDS
See also CADMIUM OXIDES
Separation Processes
Comparison of bulk, emulsion, thin sheet supported, and hollow fiber supported liquid membranes in macrocycle-mediated cation separations, 14:31428 (J;US)

CADMIUM OXIDES
Interfaces
High-resolution electron microscopy of metal/ceramic interfaces, 14:31186 (R;US)

CALCITE
Decomposition
Investigation on pyrolysis of Huangxian oil shale between 550° 750°C, 14:30344 (RA;CN)

CALCIUM
Receptors
Calcium coordination and the calmodulin fold: divergent versus convergent evolution, 14:32127 (BA;US)

CALCIUM 40
Giant Resonance
Giant dipole resonances in hot nuclear matter in the model of self-relaxing mean-field, 14:32707 (R;DE)
Monopole and quadrupole vibrations of a hot nucleus, 14:32705 (R;DE)

CALCIUM 40 TARGET
Oxygen 16 Reactions
Fusion of $^{16}O + ^{40}Ca$ at $E_{ab}(^{16}O)$=13.4 MeV/nucleon, 14:32668 (J;US)

CALCIUM 44 TARGET
Proton Reactions
Study on isomeric ratios in the /sup 45/Sc(γ,n)/sup 44mg/Sc and /sup 44/Ca(p,n)/sup 44mg/Sc reactions, 14:32666 (R;SU;In Russian)

CALCIUM CARBONATES
See also CALCITE
DOLOMITE
Chemical Analysis
Anomalous dispersion effects in diffuse reflectance infrared fourier transform spectroscopy: A study of optical geometries, 14:31882 (J;US)

CALCIUM COMPOUNDS
See also CALCIUM CARBONATES
CALCIUM HYDROXIDES
CALCIUM OXIDES
Efficiency
1.0 Million Btu combustor testing: Test results: Part 2, 14:30803 (R;US)

CALCIUM FLUORIDES
Submerged Arc Welding
Electrochemical transport of manganese between the flux and the weld metal in submerged arc welding, 14:31275 (R;US)

CALCIUM HYDROXIDES
Sorptive Properties
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 3, January 1, 1989–March 31, 1989, 14:30274 (R;US)

CALCIUM IONS
Ion-Atom Collisions
Resonant transfer and excitation in collisions of Li-like F^{6+} and Ca^{17+} with light targets, 14:32523 (J;US)
Ion-Molecule Collisions
Resonant transfer and excitation in collisions of Li-like F^{6+} and Ca^{17+} with light targets, 14:32523 (J;US)

CALCIUM OXIDES
Electric Conductivity
Fluctuation conductivity of Tl-Ba-Ca-Cu-O thin films, 14:31310 (J;US)
Microstructure
Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)
Specific Heat
Low-temperature specific heat of single-crystal $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$, 14:31313 (J;US)
Specific heat of $Bi_2Sr_2CuO_6$ and $Bi_2Sr_2CaCu_2O_8$ in the superconducting state, 14:31309 (J;US)
Submerged Arc Welding
Electrochemical transport of manganese between the flux and the weld metal in submerged arc welding, 14:31275 (R;US)
Superconductivity
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)

CALCULATIONS (COMPUTER)
See COMPUTER CALCULATIONS

CALCULI
Computerized Tomography
Importance of CT and MR in extracorporeal cholelithotripsy, 14:32226 (RA;DD;In German)
Nmr Imaging
Importance of CT and MR in extracorporeal cholelithotripsy, 14:32226 (RA;DD;In German)

CALIFORNIA
Climates
Introduction to background materials for Workshop No. 1: Global climate change and its effects on California, 14:31971 (R;US)
Geology
Lithologic composition and variability of the sediments underlying Kesterson Reservoir as interpreted from shallow cores, 14:32417 (R;US)

CALIFORNIUM 252
Neutron Spectra
Absolute measurements of the prompt neutron spectrum produced by spontaneous fission of /sup 252/Cf in the low-energy region, 14:32689 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)

CALIFORNIUM ISOTOPES
See also CALIFORNIUM 252
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)

Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)

CALORIMETERS
Fires
Thermal measurements in large pool fires, 14:31683 (J;US)

CALORIMETERS (PARTICLE)
See SHOWER COUNTERS

CANADA
See also ALBERTA
BRITISH COLUMBIA
MANITOBA
NEW BRUNSWICK
NEWFOUNDLAND
NORTHWEST TERRITORIES
NOVA SCOTIA
ONTARIO
QUEBEC
SASKATCHEWAN
Economic Growth
Alternative scenarios for corporate planning, 14:30976 (R;CA)
Long-term economic outlook. Annual review, 14:30975 (R;CA)
Prediction ranges. Annual review, 14:30974 (R;CA)
Short-term economic outlook. Annual review, 14:30973 (R;CA)
Energy Demand
Canadian energy supply and demand, 1987-2005. Summary, 14:30997 (R;CA;In French)
Energy Policy
Energy and Canadians into the 21st century. A report of the energy options process, 14:30972 (R;CA;In English and French)
Energy Source Development
Energy and Canadians into the 21st century. A report of the energy options process, 14:30972 (R;CA;In English and French)
Energy Storage
Energy storage on the supply side or the demand side, 14:30927 (R;CA)
Energy Supplies
Canadian energy supply and demand, 1987-2005. Summary, 14:30997 (R;CA;In French)
Natural Gas Industry
Natural gas market assessment, 14:30319 (R;CA)
Paleoclimatology
Holocene proxy-climate data from the Canadian Arctic, 14:32413 (R;CA)
Petroleum Industry
Petroleum Incentives Administration annual report, 1986, 14:31004 (R;CA)
Radioactive Waste Facilities
High-level liquid waste treatment: process development studies in the WIPE facility, 14:30503 (RA;US)
Research Programs
Proceedings of the 6th Canadian bioenergy research and development seminar, 14:31040 (R;CA)
Storage Facilities
Ontario inventory of approved PCB storage sites, 14:31996 (R;CA)
Water Waves
Evaluation of wave forecasting models and forecast wind fields in the Canadian context, 14:32440 (R;CA)

CANCER
See NEOPLASMS

CANDIDA
Comparative Evaluations
Comparison of Saccharomyces cerevisiae and Candida shehatae for bioconversion of corn stover hydrolyzate to ethanol, 14:30670 (RA;US)
Growth
Fermentability tests of sugars produced in the Solar Energy Research Institute's plug-flow reactor, 14:30658 (RA;US)

CANINES
See DOGS

CANISTERS
See CONTAINERS

CAPACITORS
Reliability
Evaluation of stand-alone inverters for remote applications, 14:30818 (BA;US)

CAPACITY
Why utilities should promote DSM while choking on capacity surplus, 14:31012 (RA;US)
Planning
Least-cost planning: profiting from the negawatt revolution, 14:31009 (RA;US)

CARBENES
Research Programs
[Fundamental studies of carbenes and hydrocarbon radicals]: Progress report, 14:31468 (R;US)

CARBON
See also ACTIVATED CARBON
CARBON BLACK
DIAMONDS
GRAPHITE
Adsorption
An orthogonal collocation approach to modeling multicomponent adsorption in carbon beds, 14:32037 (R;US)
Chemisorption
Comparative study of angle-resolved valence-band photoemission from half-monolayer structures of C, N, and O on Ni(100), 14:31259 (J;US)
Electron Collisions
Measurement of electron energy deposition necessary to form an anode plasma in Ta, Ti, and C for coaxial bremsstrahlung diodes, 14:32888 (J;US)
Fabrication
Low density microcellular carbon or catalytically impregnated carbon forms and process for their preparation, 14:31381 (P;US)
Physical Radiation Effects
Simulated response of multilayer x-ray reflectors to damaging fluxes, 14:31238 (J;US)
Quantitative Chemical Analysis
TEOM(trade mark) real-time carbon-concentration monitor. Final report, 14:30809 (R;US)
Surface Properties
Observation of graphitic and amorphous structures on the surface of hard carbon films by scanning tunneling microscopy, 14:31376 (J;US)

CARBON 12 TARGET
Deuteron Reactions
Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)
Lanthanum 139 Reactions
The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission, 14:32670 (R;US)
Neutron Reactions
C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels, 14:32655 (R;FR)
Oxygen 16 Reactions
Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)
Proton Reactions
Peaks in the valley: Searching for resonances in large angle exclusive scattering, 14:32565 (J;US)
Transfer Reactions
C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels, 14:32655 (R;FR)

CARBON 13 TARGET
Neutron Reactions
C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels, 14:32655 (R;FR)

Transfer Reactions
C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels, 14:32655 (R;FR)

CARBON 14 TARGET
Neutron Reactions
C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels, 14:32655 (R;FR)

Pion Plus Reactions
$^{14}C(\pi^+,\pi^-)^{14}O$ reaction between 19 and 80 MeV, 14:32657 (J;US)

Transfer Reactions
C + O reactions at energies above the barrier: influence of one and two extra neutrons on the elastic and quasi-elastic channels, 14:32655 (R;FR)

CARBON BLACK
Aerosols
Real-time measurement of the size fractionation of aerosol black carbon during the Southern California Air Quality Study, June 13–September 4, 1987, Claremont College, California, 14:31932 (R;US)

Particulates
Real-time measurement of the size fractionation of aerosol black carbon during the South Coast Air Quality Study, June 13–September 4, 1987, Claremont College, Claremont, California: Final report: Revision, 14:31930 (R;US)

Sorptive Properties
Carbonaceous solids as a model for adsorption by dispersion forces, 14:31516 (J;US)

CARBON COMPOUNDS
See also CARBONATES

Biosynthesis
Studies on the biosynthesis of the m-C_7N unit in the antibiotics manumycin and asukamycin, 14:31507 (J;US)

CARBON DIOXIDE
Atmospheric Circulation
The Argonne low level ^{14}C counting system, 14:31905 (R;US)

Chemical Reactions
Effect of pressure on the reaction of electrons with CO_2 in nonpolar solvents, 14:31572 (J;US)
Relative and kinetic properties of carbon monoxide and carbon dioxide on a graphite surface, 14:31523 (J;US)

Electron-Molecule Collisions
Subexcitation electrons in gas phase, 14:32489 (R;US)

Gas Injection
Effect of carbon dioxide on the kinetics of the Fischer-Tropsch synthesis on iron catalysts, 14:30267 (J;US)

Mass Transfer
Modeling the simultaneous transport of two acid gases in tertiary amines with reversible reactions, 14:31423 (J;US)

Membrane Transport
Studies on gas transport through dry cellulose acetate membranes prepared by solvent exchange technique, 14:31441 (J;US)

Osmosis
Permeation of gas mixtures in cellulose acetate membranes - practical approach to predict the permeation rate CO_2/CH_4 mixture, 14:31457 (J;US)

Separation Processes
Advanced gas separation membrane materials: rigid aromatic polyimides, 14:31427 (J;US)
CO_2 separation using facilitated transport ion exchange membranes, 14:31426 (J;US)
Gas separation properties of phosphazene polymer membranes, 14:31433 (J;US)
Study of nonsteady-state continuous membrane column for gas separation, 14:31438 (J;US)

Solvent Properties
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
Performance of spray, sieve tray, and packed contactors for high pressure extraction, 14:31453 (J;US)

Sorption
Effects of particle shape and size distribution on sorption and flow performance in electrically stabilized expanded beds, 14:31449 (J;US)

Supercritical State
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)

CARBON DIOXIDE LASERS
Design
Large-volume high-pressure CO/sub 2/ laser for ultrashort pulse amplification, 14:31650 (BA;US)

Performance
Compact diffusion-cooled CO/sub 2/ laser, 14:31649 (BA;US)

CARBON IONS
Charge-Exchange Reactions
Metastable enhancement of C^+ and O^+ capture reactions: Annual report, July 1, 1988–June 30,1989, 14:32491 (R;US)

CARBON MONOXIDE
Chemical Reactions
Relative and kinetic properties of carbon monoxide and carbon dioxide on a graphite surface, 14:31523 (J;US)

Desorption
Generation and detection of a monolayer grating by laser desorption and second-harmonic generation: CO on Ni(111), 14:32805 (J;US)
Quantum state resolved desorption of CO from solid surfaces: Progress report, 15 June 1988–14 June 1989, 14:31469 (R;US)

Detection
Carbon monoxide sensors. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:32411 (R;US)

Energy-Level Transitions
Photofragmentation of acetone at 193 nm: rotational- and vibrational-state distributions of the CO fragment by time-resolved FTIR emission spectroscopy, 14:31561 (J;US)

Indoor Air Pollution
Health-hazard evaluation determination report No. 77-44-435, Keller Columbus, Inc., Columbus, Ohio, 14:31948 (R;US)

Isotopic Exchange
CO isotopic exchange reaction over Rh/Al_2O_3: nondissociative exchange on metallic Rh sites, 14:31529 (J;US)

Methanation
Potential sensitivity of tunneling in isolated resonance unimolecular reaction theory, 14:31548 (J;US)

Oxidation
Kinetics of CO oxidation on single-crystal Pd, Pt, and Ir, 14:31515 (J;US)

CARBON STEELS
Corrosion
Effect of CO/sub 2//H/sub 2/S on seamless and ERW tubular goods, 14:31220 (R;CA)
Progress in the assessment of the corrosion of low and intermediate level waste containers under repository conditions, 14:31218 (R;GB)

Corrosion Protection
Effect of CO/sub 2/ on seamless and tubular goods, 14:31219 (R;CA)

Corrosion Resistance
Effect of CO/sub 2/ on seamless and tubular goods, 14:31219 (R;CA)

CARBONACEOUS MATERIALS
See also COAL

Multi-Element Analysis
Neutron activation analysis possibilities for the elemental composition research in oil-shales, oil-bituminous rocks, petroleum and their fractions, 14:30379 (RA;CN)

CARBONATES
See also CALCIUM CARBONATES

Catalytic Effects
Mini-melter studies of high level nuclear waste form development: effects of added nitrates, carbonates and nitrates/formates in the slurry feed, 14:30506 (RA;US)

CARBONYLS
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
CARBOXYLASE
Molecular Structure
Structural and evolutionary aspects of the key enzymes in photorespiration; RuBisCO and glycolate oxidase, 14:32126 (BA;US)
CARBOXYLIC ACID SALTS
See also ACETATES
ACRYLATES
FORMATES
Gas Chromatography
Capillary gas chromatographic separation of alkyl nitrates and peroxycarboxylic nitric anhydrides, 14:31411 (J;US)
Photolysis
Interaction of halide and pseudohalide ions with triplet benzophenone-4-carboxylate: kinetics and radical yields, 14:31559 (J;US)
CARBOXYLIC ACIDS
See also AMINO ACIDS
MELLITIC ACID
Removal
Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
Synthesis
Aspects of nonfuel utilization of oil shales based on their oxidation, 14:30395 (RA;CN)
Electrochemical oxidation of oil shale, 14:30396 (RA;CN)
Study of oxidation technique of oil shale, 14:30382 (RA;CN)
CARCINOMAS
Bronchi
CT and MRI in the evaluation of bronchogenic carcinoma, 14:32283 (RA;DD)
N classification in preoperative staging of bronchial cancer by means of CT, 14:32286 (RA;DD;In German)
Computerized Tomography
MRT and CT of the esophageal cancer, 14:32252 (RA;DD;In German)
N classification in preoperative staging of bronchial cancer by means of CT, 14:32286 (RA;DD;In German)
Diagnosis
Radiology of lobular carcinoma of breast in situ, 14:32214 (RA;BR;In Spanish)
Radiology of medullar carcinoma of breast, 14:32213 (RA;BR;In Spanish)
Mammary Glands
Radiology of lobular carcinoma of breast in situ, 14:32214 (RA;BR;In Spanish)
Radiology of medullar carcinoma of breast, 14:32213 (RA;BR;In Spanish)
Nmr Imaging
MRT and CT of the esophageal cancer, 14:32252 (RA;DD;In German)
CARDIOVASCULAR DISEASES
See also ISCHEMIA
Nmr Imaging
MR diagnosis in vascular diseases, 14:32282 (RA;DD)
NMR imaging in carditis and cardiomyopathies, 14:32278 (RA;DD;In German)
CARTILAGE
Exercise
Exercise-induced changes of the articular cartilage diagnosed by /sup 1/H-NMR relaxation spectroscopy, 14:32268 (RA;DD;In German)
Nmr Spectra
Exercise-induced changes of the articular cartilage diagnosed by /sup 1/H-NMR relaxation spectroscopy, 14:32268 (RA;DD;In German)
CASCADE (EXTRACTION)
See EXTRACTION COLUMNS
CASCADES (NUCLEAR)
See NUCLEAR CASCADES
CASKS
See also SPENT FUEL CASKS
Radiation Monitoring
Automatic measuring station to monitor radioactive waste containers, 14:30630 (RA;AT;In German)
CAST IRON
Fracture Properties
Dynamic fracture behavior of nodular cast iron, 14:31206 (R;BR)
CASTE (INSECTS)
See POPULATIONS
CATALYSTS
Biomimetic catalysis: Hydroxylation of C_2, C_3, and cycloC_6 hydrocarbons by managanese porphyrin and non-porphyrin catalysts in the presence of monooxygen transfer reagents, 14:30706 (R;US)
Chemical Composition
Coal liquefaction process solvent characterization and evaluation: Technical progress report, April 1–June 30, 1988, 14:30259 (R;US)
Chemical Preparation
Catalyst development for hydrodeoxygenation and dealkylation of lignins for fuels, 14:30735 (RA;US)
Probing metal cluster formation in NaY zeolite by ^{129}Xe NMR, 14:31508 (J;US)
Deactivation
Analytical electron microscopy of catalyst promoters, poisons, and active species: Progress report, [July 1986–September 1988], 14:31470 (R;US)
Decomposition
The degradation study of metals-tolerant fluid catalytic cracking catalyst by molecular probes. Final report, 14:30296 (R;CA)
Microanalysis
Characterisation of novel matrix catalysts and catalyst selectivity control for alpha olefin synthesis on the basis of CO and H/sub 2/, 14:30264 (R;DE;In German)
Recovery
Bench-scale co-processing: Quarterly report No. 2, July 1, 1988–September 30, 1988, 14:30261 (R;US)
Specificity
Characterisation of novel matrix catalysts and catalyst selectivity control for alpha olefin synthesis on the basis of CO and H/sub 2/, 14:30264 (R;DE;In German)
CATALYTIC CONVERTERS
Performance Testing
Evaluation of a resistively heated metal-monolith catalytic converter on a gasoline-fueled vehicle. Technical report, 14:31160 (R;US)
CATALYTIC CRACKING
Catalysts
The degradation study of metals-tolerant fluid catalytic cracking catalyst by molecular probes. Final report, 14:30296 (R;CA)
CATAWBA-2 REACTOR
Seismic Effects
Seismic margin assessment of the Catawba Nuclear Station: Volume 2, Appendixes: Final report, 14:30902 (R;US)
CATECHOL
See PYROCATECHOL
CATHODES
See also PHOTOCATHODES
Fabrication
Simple, high current LaB_6 cathode, 14:32937 (J;US)
Materials Testing
Influence of electrolyte density on response of LiCl, 14:30968 (BA;US)
CATION EXCHANGE CAPACITY
See CATIONS
CATIONS
See also HYDROGEN IONS 1 PLUS
Hydration
Viewing the born model for ion hydration through a microscope, 14:31476 (BA;US)

CATS
Hazards
Free-ranging dogs and cats on the Oak Ridge Reservation: Situation and solution, 14:32409 (R;US)
Management
Free-ranging dogs and cats on the Oak Ridge Reservation: Situation and solution, 14:32409 (R;US)
CAVITIES
See also BOREHOLES
Design
Improvements to a transmission-line model of a main-ring cavity, 14:31752 (R;US)
CAVITY RESONATORS
See also SUPERCONDUCTING CAVITY RESONATORS
Tuning
Tuning magnet power supply, 14:31754 (R;US)
CDTA
Iron Compounds
Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)
Moessbauer Effect
Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)
CELL GROWTH (ANIMAL)
See ANIMAL CELLS
CELL GROWTH (PLANT)
See PLANT CELLS
CELL MEMBRANES
Biochemistry
Facing up to membranes: structure/function relationships in phospholipases, 14:32122 (BA;US)
CELL WALL
Delignification
Cell wall mechanisms of resistance to enzymatic hydrolysis, 14:30729 (RA;US)
Mechanisms of plant cell wall resistance to polysaccharide degrading enzymes: a study using nuclear magnetic resonance analysis, 14:30730 (RA;US)
CELLOBIOSE
Fermentation
Optimization of cellulase productivity from Acidothermus cellulolyticus, 14:30725 (RA;US)
CELLS (ANIMAL)
See ANIMAL CELLS
CELLS (BACTERIAL)
See BACTERIA
CELLS (PLANT)
See PLANT CELLS
CELLULASE
Adsorption
Hydrolysis of cellulose by purified cellulase components: synergistic effects, 14:30720 (RA;US)
Enzyme Activity
Digestion of pretreated aspen substrates: hydrolysis rates and adsorptive loss of cellulase enzymes, 14:30715 (RA;US)
Enzyme production on cellulose/xylose mixture, 14:30723 (RA;US)
Enzymology research, 14:30714 (RA;US)
Improvements of enzymatic hydrolysis of cellulose: strain development of Trichoderma reesei, 14:30726 (RA;US)
Optimization of cellulase productivity from Acidothermus cellulolyticus, 14:30725 (RA;US)
Thermostable cellulase enzymes from Acidothermus cellulolyticus: studies with growth media activities, 14:30721 (RA;US)
Enzyme Induction
Enhancement of cellulase production of Trichoderma reesei in fluidized bed reactor, 14:30724 (RA;US)
Fractionation
Purification and partial characterization of two endoglucanases from Acidothermus cellulolyticus, 14:30722 (RA;US)
Molecular Structure
Targeted modifications to the structure of Trichoderma reesei CBHII, 14:30727 (RA;US)
Sorption
Integrated process for production of ethanol, 14:30664 (RA;US)
Stoichiometry
Visualization and stoichiometry of the active-enzyme cellulase complex from Trichoderma reesei, 14:30719 (RA;US)
CELLULASES
See CELLULASE
CELLULOSE
Acid Hydrolysis
Acid recovery of polyamine, 14:30661 (RA;US)
Comparison of Saccharomyces cerevisiae and Candida shehatae for bioconversion of corn stover hydrolyzate to ethanol, 14:30670 (RA;US)
Concentrated acid hydrolysis with acid recovery, 14:30662 (RA;US)
Dilute acid hydrolysis of high solids woods slurries in a two-stage continuous flow process, 14:30657 (RA;US)
Dilute acid pretreatment of biomass, 14:30711 (RA;US)
Effect of non-uniform temperature distribution on acid hydrolysis of Aspen hemicellulose, 14:30728 (RA;US)
Ethanol from cellulosic residues and crops, 14:30660 (RA;US)
Overview of acid hydrolysis of lignocellulosics to liquid fuels, 14:30656 (RA;US)
Bioconversion
Packed bed hydrodynamics of an acid hydrolysis percolation reactor, 14:30659 (RA;US)
Enzymatic Hydrolysis
Beta-glucosidase crosslinking for stability and enzyme recycle, 14:30717 (RA;US)
Cell wall mechanisms of resistance to enzymatic hydrolysis, 14:30729 (RA;US)
Digestion of pretreated aspen substrates: hydrolysis rates and adsorptive loss of cellulase enzymes, 14:30715 (RA;US)
Economic evaluation of pretreatment and non-pretreatment vendor size tests and costs for commercialization of the continuous enzymatic SSF for production of ethanol from cellulose waste, 14:30665 (RA;US)
Effect of thermo-chemical pretreatment on the enzymatic hydrolysis of lignocellulosic substrates I, 14:30731 (RA;US)
Ethanol from lignocellulose: the DOE/SERI Biochemical Conversion/Alcohol Fuels Program, 14:30655 (RA;US)
Hydrolysis of cellulose by purified cellulase components: synergistic effects, 14:30720 (RA;US)
Improvements of enzymatic hydrolysis of cellulose: strain development of Trichoderma reesei, 14:30726 (RA;US)
Integrated process for production of ethanol, 14:30664 (RA;US)
Mixing requirements for enzymatic hydrolysis of cellulose, 14:30713 (RA;US)
Organosolv pretreatment, 14:30666 (RA;US)
Overview of enzymatic hydrolysis research, 14:30663 (RA;US)
Simultaneous saccharification and fermentation of cellulose and wheat straw to ethanol: evaluation of thermotolerant yeast and B-glucosidase supplementation, 14:30667 (RA;US)
Visualization and stoichiometry of the active-enzyme cellulase complex from Trichoderma reesei, 14:30719 (RA;US)
Permeability
Permeation of gas mixtures in cellulose acetate membranes - practical approach to predict the permeation rate CO_2/CH_4 mixture, 14:31457 (J;US)
Porosity
Studies on gas transport through dry cellulose acetate membranes prepared by solvent exchange technique, 14:31441 (J;US)
CEMENTS
See also PORTLAND CEMENT
Chemical Composition
Sixteenth progress report contract to develop an asbestos cement (A/C) cooling tower fill for thermal generating plants. Report no. 23, 14:31665 (R;CA)
Materials Testing
Sixteenth progress report contract to develop an asbestos cement (A/C) cooling tower fill for thermal generating plants. Report no. 23, 14:31665 (R;CA)

Physical Radiation Effects
Radiation effects on metals, alloys and cement, 14:31200 (RA;BR)
Radiation effects on metals, alloys and cement, 14:31213 (R;BR)
Waste Product Utilization
Multipurpose use of shale ash and its paragenetic mineral in China, 14:30404 (RA;CN)
Weathering
Sixteenth progress report contract to develop an asbestos cement (A/C) cooling tower fill for thermal generating plants. Report no. 23, 14:31665 (R;CA)

CENTRAL RECEIVERS
Performance
A preliminary assessment of the effect of sunshape on the performance of central receiver systems, 14:30751 (R;US)

CENTRIFUGAL SEPARATORS
See INERTIAL SEPARATORS

CERAMICS
Ceramic Technology for Advanced Heat Engines Project data base: September 1988 summary report, 14:31159 (R;US)
Chemical Analysis
Characterization and comparison of highly radioactive and simulated glass and glass ceramic waste forms, 14:30511 (RA;US)
Chemical Properties
Physico-chemical properties of supported and unsupported γ-Al_2O_3 and TiO_2 ceramic membranes, 14:31432 (J;US)
Crack Propagation
Fracture mechanics of crack branching in ceramics, 14:31288 (BA;US)
Etching
Laser-initiated chemical vapor etching of ceramics, 14:31289 (BA;US)
Fabrication
Numerical computation of bifurcation phenomena and pattern formation in combustion, 14:31273 (R;US)
Fracture Mechanics
Fractographic determination of crack-tip stress intensity, 14:31290 (BA;US)
Fracture Properties
Development of tough ceramics. Final report, 14:31320 (R;CA)
Multifractal fracture, 14:31299 (J;US)
Gas Turbine Engines
Ceramics technology: automotive gas-turbine-engine component applications. January 1976-April 1989 (Citations from the NTIS data base). Report for January 1976-April 1989, 14:31285 (R;US)
Grain Boundaries
Grain-boundary modeling, 14:31235 (BA;US)
Joining
Ceramic joining in the United States, 14:31287 (R;US)
Market
Future applications of engine ceramics: Factors influencing market opportunities, timing, and growth, 14:31157 (R;US)
Matrix Materials
Characterization of mechanical damage mechanisms in ceramic composite materials. Technical report, 23 May 1987-24 May 1988, 14:31314 (R;US)
Microstructure
The use of heteroepitaxy in the fabrication of bicrystals for the study of grain boundary structure, 14:31298 (J;US)
Nmr Imaging
Nuclear magnetic resonance imaging for quality control in the production of advanced ceramic components, 14:31863 (R;US)
Performance Testing
Development of a ceramic-based waste form to immobilize ICPP HLW, 14:30516 (RA;US)
Research Programs
Development of tough ceramics. Final report, 14:31320 (R;CA)
Metals and Ceramics Division progress report for period ending September 30, 1988, 14:31174 (R;US)

CERAMICS INDUSTRY
Energy Conservation
A technology status report energy usage and microwave heating potential in Ontario ceramics industry, 14:31120 (R;CA)

CEREALS
See also WHEAT
Radiodisinfestation
Radiation disinfestation of stored cereals, 14:30644 (R;FR;In French)

CEREBRUM
Computerized Tomography
Subcortical arteriosclerotic encephalopathy (SAE) in CT and clinical study, 14:32332 (RA;DD)
Ischemia
Subcortical arteriosclerotic encephalopathy (SAE) in CT and clinical study, 14:32332 (RA;DD)

CERIUM
Solvent Extraction
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)

CERIUM ALLOYS
Catalytic Effects
Development of ternary alloy cathode catalysts for phosphoric acid fuel cells: Final report, 14:31043 (R;US)

CESIUM
Fallout Deposits
Resuspension of radionuclides during cultivation. Results from a single sample analysis, Spring 1987, 14:32007 (R;SE;In Swedish)
Molecule-Molecule Collisions
Excitation-transfer collisions in cesium vapor: CS(5d (5/2)) + CS(6s (1/2)) yields CS(5d (3/2)) + CS(6s (1/2)), 14:32481 (R;US)
Photoionization
Absolute photoionization cross sections of the Cs $7D_{3/2}$ level measured by use of fluorescence reduction, 14:32520 (J;US)

CESIUM 124
Radioecological Concentration
Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)

CESIUM 134
Measurements on internal contamination in Budapest due to the Chernobyl accident, 14:32019 (RA;AT)

CESIUM 137
Intake
Assessment of internal contamination with a whole body counter, 14:31847 (RA;AT)
Ion Exchange
Improved ion exchange method for treatment of slightly contaminated wastewaters, 14:30459 (RA;US)
Radioecological Concentration
/sup 131/I-activity in man's thyroid and /sup 137/Cs-activity in muscle tissue, 14:32014 (RA;AT;In German)
Cesium- and iodine contamination of food in South Tyrol, Italy, 14:32362 (RA;AT;In German)
Measurements on internal contamination in Budapest due to the Chernobyl accident, 14:32019 (RA;AT)
Radiation burden of soil and vegetation in South Tyrol, Italy, after the Chernobyl accident, 14:32020 (RA;AT;In German)
Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)
Radiocesium in wheat of the Po plain, 14:31983 (R;FR;In Italian)
Removal
Supernatant treatment system at the West Valley Demonstration Project, 14:30460 (RA;US)

CESIUM CHLORIDES
Diffusion
A radially perfused cell for measuring diffusion in compacted, highly sorbing media, 14:31353 (J;US)

CESIUM COMPOUNDS
See also CESIUM CHLORIDES
Separation Processes
Proton-ionizable crown compounds: transport of alkali and alkaline earth cations using proton-ionizable triazolo macrocycles, 14:31439 (J;US)

CFFF
See MHD GENERATOR CFFF

CHALK RIVER NUCLEAR LABS
Operation
Operational experience with the DATS sampler during the Canadian tritium modeling experiment, 14:32961 (J;US)
CHALKS
See LIMESTONE
CHARCOAL
Sorptive Properties
Fluorine gettering by activated charcoal in a radiation environment, 14:31448 (J;US)
CHARGE DENSITY
Mode Locking
Mode locking in overdamped charge-density-wave systems, 14:31324 (R;DK)
CHARGE INDEPENDENCE
Nambu–Jona-Lasinio model and charge independence, 14:32622 (J;US)
CHARGED PARTICLES
See also DEUTERONS
IONS
TRITONS
Images
High-order corrections to the image potential, 14:32815 (J;US)
Monitoring
Micron-sized-particle impacts detected near Uranus by the Voyager 2 plasma-wave instrument. Progress report for period ending 1986, 14:32442 (R;US)
CHARGED-PARTICLE ACTIVATION
See ACTIVATION ANALYSIS
CHARGED PARTICLES
CHARGED-PARTICLE TRANSPORT
Monte Carlo Method
Criticality benchmarks for COG: A new point-wise Monte Carlo code, 14:32754 (R;US)
CHARM PARTICLES
See also F MESONS
Detection
Observation of excited charmed mesons, 14:32571 (J;US)
CHARMONIUM
See also J PSI-3097 MESONS
Physical Properties
The fermilab E-760 charmonium detector, 14:31857 (J;US)
CHARPAK CHAMBERS
See MULTIWIRE PROPORTIONAL CHAMBERS
CHARS
Combustion
Coal Combustion Science quarterly progress report, October–December 1988, 14:30282 (R;US)
Combustion Kinetics
Study on the combustion kinetics of Fushun and Maoming shale char particles, 14:30398 (RA;CN)
Market
Industrial market assessment of the products of mild gasification: Final report, 14:30251 (R;US)
Structural Chemical Analysis
Comparison of extracts and yields from the thermal solution of a typical Green River oil shale and a Sunbury oil shale, 14:30384 (RA;CN)
CHEMICAL EFFLUENTS
Biological Effects
Evaluation of stream biological communities in nonthermal reaches of Four Mile Creek: Revision 1, 14:32052 (R;US)
Minimization
Illustrative emission reduction scenarios, 14:31922 (R;US)
CHEMICAL EXPLOSIVES
See also NITROMETHANE
TATB
TNT
Detection
Characteristics of select glass tube preconcentrators used with an ion mobility spectrometer, 14:31871 (R;US)
Recommendations
Preferred explosives for blasting in oil shale mines, 14:30335 (RA;CN)
CHEMICAL FEEDSTOCKS
Production
Potential production of specialty chemicals from oil shale in the United States, 14:30412 (RA;CN)
CHEMICAL HEAT PUMPS
Design
Chemical heat pump study. Final report., 14:31129 (R;CA)
CHEMICAL INDUSTRY
Hazardous Materials
Industrial-hygiene survey report, Cain Chemical, Inc., Bayport Plant, Pasadena, Texas, June 1-2, 1988, 14:31953 (R;US)
Industrial-hygiene survey, Bachmeier and Company, Kearny, New Jersey, November 4-8, 1985, 14:31952 (R;US)
Resistance Heating
Steam substitution in chemical process, petrochemical and petroleum industries, 14:31130 (R;CA)
Steam Systems
Steam substitution in chemical process, petrochemical and petroleum industries, 14:31130 (R;CA)
CHEMICAL REACTION KINETICS
See also COMBUSTION KINETICS
High temperature deviations from Rice–Ramsberger–Kassel–Marcus unimolecular rate coefficients expressions, 14:31480 (J;US)
Gas Analysis
Analysis of low-pressure gas-phase pyrolytic reactions by mass spectrometric techniques, 14:31582 (R;DK)
Least Square Fit
Solving the non-isothermal kinetic curves of gas-solid reactions by non-linear fitting method, 14:31465 (R;CN;In Chinese)
Mathematical Models
Effect of fluctuations in state-specific unimolecular rate constants on the pressure dependence of the average unimolecular reaction rate, 14:31500 (J;US)
CHEMICAL REACTION YIELD
Chemical Composition
Analysis of elements produced in TCDDC system by mass spectrometry, 14:31387 (RA;BR;In Portuguese)
Crystal Structure
Analysis of elements produced in TCDDC system by mass spectrometry, 14:31387 (RA;BR;In Portuguese)
Mass Spectroscopy
Analysis of elements produced in TCDDC system by mass spectrometry, 14:31387 (RA;BR;In Portuguese)
Mixtures
Analysis of elements produced in TCDDC system by mass spectrometry, 14:31387 (RA;BR;In Portuguese)
CHEMICAL REACTIONS
See also FISCHER-TROPSCH SYNTHESIS
PHOTOCHEMICAL REACTIONS
POLYMERIZATION
B Codes
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 3, January 1, 1989–March 31, 1989, 14:30274 (R;US)
Dynamics
Classical and quantum pictures of reaction dynamics in condensed matter: resonances, dephasing, and all that, 14:31535 (J;US)
CHEMICAL REACTORS
See also RETORTS
Design
Analysis of cobalt extraction by di-(2-ethylhexyl) phosphoric acid in a continuous flow stirred tank with a laser capillary spectrophotometer, 14:31421 (J;US)
Performance
Fluidized bed electrowinning of chromium from very dilute solutions, 14:31450 (J;US)
Waste Processing
Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)
Welded Joints
Weld overlay disbonding, 14:31232 (R;CA)

CHEMICAL VAPOR DEPOSITION
Window cleaning and fluorine incorporation by XeF_2 in photochemical vapor deposition, 14:31679 (J;US)

Ultraviolet Radiation
Chemically amplified laser direct-writing of aluminum, 14:31341 (BA;US)

CHEMICAL WARFARE
Non-Proliferation Policy
Legal aspects of implementing a global chemical weapons convention under domestic laws, 14:31169 (R;US)

CHEMICAL WARFARE AGENTS
Chemical and biological warfare: protection, decontamination, and disposal. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989, 14:31601 (R;US)

Deforestation
Chemical and biological warfare: defoliants and herbicides. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31474 (R;US)

Herbicides
Chemical and biological warfare: defoliants and herbicides. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31474 (R;US)

Risk Assessment
Risk associated with the demilitarization of the United States chemical weapons stockpile, 14:31167 (R;US)

CHEMISTRY (WATER)
See WATER CHEMISTRY

CHERENKOV COUNTERS
Photoelectron Counting
Design and develpment of photoelectron detection chambers for the DELPHI experiment RICH Cerenkov counters, 14:31809 (R;FR;In French)

CHERENKOV DETECTORS
See CHERENKOV COUNTERS

CHERNOBYLSK-4 REACTOR
Accidents
Chernobyl - radioactivity in sludge produced in wastewater treatment plants, 14:30924 (R;SE;In Swedish)
Standby after the Chernobyl accident, 14:30907 (R;SE;In Swedish)
What did they say? on radio and TV about Chernobyl and how did we experience the information?, 14:30923 (R;SE;In Swedish)

Burnup
Estimation of the nuclide inventory of the Chernobyl core at the time of accident, 14:30846 (RA;AT)

Fallout
25 years of in vivo measurements of transuranes at KFK, 14:31844 (RA;AT;In German)
Activity concentration in the discharge of a sewage purification plant, 14:30918 (RA;AT;In German)
Assessment of internal contamination with a whole body counter, 14:31847 (RA;AT)
Chernobyl - measurements by the Austrian Environmental Protection Agency, 14:32017 (RA;AT)
Chernobyl accident and its radiological impact for Austria, 14:30917 (RA;AT;In German)
Estimation of the nuclide inventory of the Chernobyl core at the time of accident, 14:30846 (RA;AT)
Measurements for the estimation of the external doses in Hungary from Chernobyl release, 14:32016 (RA;AT)
Method for the retrospective determination of contamination from the Chernobyl accident. Gamma spectroscopic evaluation of woodpiles, 14:32018 (RA;AT;In German)
Summary of the impact of the Chernobyl release on the Belgian territory, 14:32013 (RA;AT)

Reactor Accidents
Bikini accident and Chernobyl accident, 14:32389 (RA;AT)
Chernobyl nuclear reactor accident fallout: measurement and consequences. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:30919 (R;US)

Shutdowns
Estimation of the nuclide inventory of the Chernobyl core at the time of accident, 14:30846 (RA;AT)

CHESAPEAKE BAY
Water Pollution
Contribution of atmospheric nitrate deposition to nitrate loading in the Chesapeake Bay. Final report, 14:32045 (R;US)

Water Quality
Chesapeake Bay mainstem monitoring program statistical and analytical support contract: final report, Volume 1, 14:32039 (R;US)
Chesapeake bay mainstem monitoring program statistical and analytical support contract: final report, volume 2, 14:32040 (R;US)

CHEST
Nmr Imaging
Conventional and fast NMR imaging in expanding processes of the thorax, 14:32284 (RA;DD;In German)

CHI RESONANCES
See MESONS

CHI-2800 RESONANCES
See MESONS

CHI-3455 RESONANCES
See MESONS

CHILDREN
Icrp Critical Group
Radiation burden of a critical group of children by K-40 taken by food, 14:32383 (RA;AT)

CHINA
Air Conditioning
Analysis of air-conditioning system with chilled-water storage in aquifer, 14:30949 (RA;CA;In English and French)
Economical effect of the introduction of aquifer cold preservation for air-conditioning and temperature lowering of Shanghai Hongqido Airport, 14:30952 (RA;CA;In English and French)

Aquifers
Application of stable isotopes to hydrogeology in coal mine, 14:32063 (RA;XA)

Brines
Origin of the yellow brine and the black brine in Sichuan Basin, 14:32065 (RA;XA)

Fluidized Bed Boilers
Fluid-bed boiler burning particulate Maoming oil shale, 14:30401 (RA;CN)
Initiation and development of fluidized-bed boilers for oil shale in China, 14:30408 (RA;CN)

Ground Water
Application of S. H. and O. stable isotopes to groundwater research in China, 14:32057 (RA;XA)
Applications of environmental tritium and carbon-14 in water resources investigation in Taiyuan region China, 14:32054 (RA;XA)
Environmental isotope investigation of groundwaters in the region of Taiyuan, Shanxi Province of China, 14:32058 (RA;XA)
Environmental isotope study related to groundwater age, flow system and saline water origin in Quaternary aquifers of North China Plain, 14:32055 (RA;XA)
Origin of the yellow brine and the black brine in Sichuan Basin, 14:32065 (RA;XA)
Study of the groundwater origin in Hebei Plain with isotopic method, 14:32067 (RA;XA)

Hydrology
Environmental isotope study related to groundwater age, flow system and saline water origin in Quaternary aquifers of North China Plain, 14:32055 (RA;XA)

Oil Shale Deposits
Feature of distribution and suggestion on the development and utilization of oil shale in China, 14:30329 (RA;CN)
Geological types of oil shale deposits in China, 14:30328 (RA;CN)
Relationship between oil shales and low-matured heavy oil pools in Huanghua depression, 14:30332 (RA;CN)

Oil Shale Industry
Ideas on the development of Maoming oil shale and shale oil industry, 14:30415 (RA;CN)

Shale oil industry in Maoming, 14:30414 (RA;CN)
Sixty years of oil shale retorting industry in Fushun, 14:30368 (RA;CN)

Oil Shale Processing Plants
Economic assessment of the Fushun type commercial shale oil plant, 14:30413 (RA;CN)

Petroleum Deposits
Relationship between oil shales and low-matured heavy oil pools in Huanghua depression, 14:30332 (RA;CN)

Radioactive Waste Facilities
Review of research and development of high level liquid waste vitrification in China, 14:30504 (RA;US)

Seasonal Thermal Energy Storage
Research on energy storage in the underground water and its quality in Changzhou city, 14:30955 (RA;CA;In English and French)

Technology Assessment
The future of Chinese science, 14:30988 (R:US)

Thermal Springs
Application of oxygen and hydrogen isotopes of waters in Tengchong hydrothermal systems of China, 14:32056 (RA;XA)
Origin of the yellow brine and the black brine in Sichuan Basin, 14:32065 (RA;XA)
Review of data of oxygen and hydrogen isotope composition in thermal waters in China, 14:32064 (RA;XA)

CHLOR-ALKALI INDUSTRY
See CHEMICAL INDUSTRY

CHLORATES
Nuclear Magnetic Resonance
Characterization of interstitial hydrogen within metal clusters in $Zr_6Cl_{12}H$ and $ZrClO_xH_y$ by solid-state nuclear magnetic resonance, 14:31518 (J;US)

CHLORELLA
Enzyme Activity
Site-specific single strand endonuclease activity induced by NYs-1 virus infection of a Chlorella-like green alga, 14:32200 (J;GB)

CHLORIDES
See also ALUMINIUM CHLORIDES
BARIUM CHLORIDES
CESIUM CHLORIDES
COPPER CHLORIDES
INDIUM CHLORIDES
IRON CHLORIDES
MERCURY CHLORIDES
POTASSIUM CHLORIDES
SODIUM CHLORIDES
STRONTIUM CHLORIDES
TIN CHLORIDES
ZINC CHLORIDES

Nuclear Magnetic Resonance
Characterization of interstitial hydrogen within metal clusters in $Zr_6Cl_{12}H$ and $ZrClO_xH_y$ by solid-state nuclear magnetic resonance, 14:31518 (J;US)

CHLORINATED AROMATIC HYDROCARBONS
Liquid Metals
Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)

Storage Facilities
National inventory of PCB waste storage sites, 14:31994 (R;CA)

Waste Processing
Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)

Waste Storage
Ontario inventory of approved PCB storage sites, 14:31996 (R;CA)

CHLORINE COMPOUNDS
See also CHLORATES
CHLORIDES

Photolysis
Interaction of halide and pseudohalide ions with triplet benzophenone-4-carboxylate: kinetics and radical yields, 14:31559 (J;US)

CHLORINE IONS
Recombination
Dielectronic recombination of P^{5+} and Cl^{7+} in configuration-average, *LS*-coupling, and intermediate-coupling approximations, 14:32527 (J;US)

CHLORINS
Structural Chemical Analysis
Crystal and molecular structure of a nickel isobacteriochlorin derived from a chlorophyll, 14:32185 (BA;US)

CHLOROPHYLL
Derivatization
Crystal and molecular structure of a nickel isobacteriochlorin derived from a chlorophyll, 14:32185 (BA;US)

Raman Spectroscopy
Resonance Raman spectra of electrochemically generated chlorophyll a cation radical, 14:31554 (J;US)

CHLOROPLASTS
Biological Evolution
Genetic system of chloroplasts, 14:32158 (BA;US)

CHONDRITES
Energy-Loss Spectroscopy
Electron Energy-Loss Spectroscopy: Fundamentals and applications in the characterization of minerals, 14:31394 (R;US)

CHONDROSARCOMAS
See SARCOMAS
SKELETAL DISEASES

CHORDATES
See VERTEBRATES

CHROMATID DELETIONS
See CHROMOSOMAL ABERRATIONS

CHROMATIN
See also NUCLEOSOMES

Molecular Structure
Preparation and characterization of soluble macronuclear chromatin from the hypotrich Euplotes eurystomus, 14:32198 (J;GB)

CHROMATOGRAPHIC COLUMNS
See EXTRACTION COLUMNS

CHROMIUM
Cadmium
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)

Chemical Bonds
Dependence of $K\beta/K\alpha$ ratio on the chemical constitution of the atom in Cr, Mn and Fe, 14:32498 (RA;BR)

Electrodeposition
Fluidized bed electrowinning of chromium from very dilute solutions, 14:31450 (J;US)

Magnetic Semiconductors
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)

Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)

Selenium
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)

X-Ray Emission Analysis
Dependence of $K\beta/K\alpha$ ratio on the chemical constitution of the atom in Cr, Mn and Fe, 14:32498 (RA;BR)

CHROMIUM ALLOYS
Corrosion
Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)

Grain Refinement
Effects of multiple reductions on grain refinement during hot working of alloy 718, 14:31225 (R;US)

Microstructure
The hot deformation behavior of an as-cast alloy 718 ingot, 14:31226 (R;US)

CHROMIUM COMPLEXES
Chemical Reactions
Metal arene complexes in coal structure determination: Quarterly reports, September 1988–February 1989, 14:30270 (R;US)
Reactions of low-valent transition-metal complexes with hydrogen peroxide. Are they Fenton-like or not? 1. The case of Cu^{+}_{aq} and Cr^{2+}_{aq}, 14:31501 (J;US)
CHROMIUM OXIDES
Thin Films
Metal/zirconia interfacial reactions in solid oxide fuel cell anodes, 14:31048 (BA;US)
CHROMIUM-MOLYBDENUM STEELS
Welded Joints
Weld overlay disbonding, 14:31232 (R;CA)
CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS
CHROMOSOMAL ABERRATIONS
Measuring Instruments
Development of a system for the automatic analysis of chromosome aberrations, 14:32387 (RA;AT)
CHROMOSOME ABERRATIONS
See CHROMOSOMAL ABERRATIONS
CHROMOSOME EXCHANGES
See CHROMOSOMAL ABERRATIONS
CHROMOSOME FRAGMENTS
See CHROMOSOMAL ABERRATIONS
CHROMOSOMES
Classification
Process of labeling specific chromosomes using recombinant repetitive DNA, 14:32176 (P;US)
CIRCUITS (ELECTRONIC)
See ELECTRONIC CIRCUITS
CIRCUITS (MAGNETIC)
See MAGNETIC CIRCUITS
CISTRONS
See GENES
CITIES
See URBAN AREAS
CITRIC ACID
Hydrates
Criteria for choice of decontaminating agents for trouble-free processing of radioactive waste waters from the control area of nuclear power plants, 14:30568 (RA;AT;In German)
CLADDING-FUEL INTERACTIONS
See FUEL-CLADDING INTERACTIONS
CLATHRATES
Chemical Reactions
Influence of swelling on reaction efficiency in intercalated clay minerals, 14:31530 (J;US)
CLAYS
Influence of swelling on reaction efficiency in intercalated clay minerals, 14:31530 (J;US)
Programming
X-ray diffraction identification of clay minerals by microcomputer, 14:32430 (R;BR;In Portuguese)
X-Ray Diffraction
X-ray diffraction identification of clay minerals by microcomputer, 14:32430 (R;BR;In Portuguese)
CLEAN AIR ACT
Development and validation of a test method for acrylonitrile emissions, 14:31951 (R;US)
CLEAN ROOMS
Design
Technical aspects of the upgrade and commissioning of the tritium and related systems at TFTR, 14:32944 (J;US)
CLIMATE MODELS
Comparative Evaluations
Simplified climate models: Rationale and design, 14:31912 (R;US)
CLIMATES
Evaluation
The LBL/AGMEF/JSU El Yunque Environmental Research Initiative, 14:31933 (R;US)
Modifications
Criteria for selecting a CO_2/climate change region of study, 14:31920 (R;US)
CLOSURES
Forecasting
Computed and measured responses of a thick-walled hollow cylinder of salt subjected to both homogeneous and inhomogeneous loading, 14:30585 (R;US)
Mathematical Models
Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 14:30582 (R;US)
CLOUDS
See also RADIOACTIVE CLOUDS
Mathematical Models
Simulations of cloud condensation droplet nucleation and growth, 14:31910 (R;US)
CLUSTER BEAMS
Beam Production
Focusing of particle beams using two-stage laser ablation, 14:32517 (J;US)
Focusing
Focusing of particle beams using two-stage laser ablation, 14:32517 (J;US)
CLUSTERS (ION)
See ION PAIRS
CLUSTERS (SOLID)
See SOLID CLUSTERS
CO-GENERATION
See COGENERATION
COAGULATION (BLOOD)
See BLOOD COAGULATION
COAL
See also SUBBITUMINOUS COAL
Biodegradation
Coal solubilization by lower fungi, 14:30248 (R;US)
Chemical Composition
Alberta Research Council [research reports], 14:30372 (R;CA)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, April 1–June 30, 1988, 14:30259 (R;US)
Coprocessing
Alberta Research Council [research reports], 14:30372 (R;CA)
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986, 14:30253 (R;US)
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987, 14:30255 (R;US)
Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986, 14:30254 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988, 14:30258 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987, 14:30256 (R;US)
Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987, 14:30257 (R;US)
Desulfurization
Microbial removal of organic sulfur from coal: Final report, October 1985–September 1988, 14:30262 (R;US)
Thermal decomposition of New Brunswick oil shale, 14:30397 (RA;CN)
Devolatilization
Coal Combustion Science quarterly progress report, October–December 1988, 14:30282 (R;US)
Dewatering Equipment
Development of the electroacoustic dewatering (EAD) process for fine/ultrafine coal: Second quarterly progress report period ending 31 March 1989, 14:30239 (R;US)
Dissolution
Coal solubilization by enhanced enzyme activity in organic solvents, 14:30247 (R;US)

Fluidized-Bed Combustion
Utilization potential of circulating fluidized bed combustion residue in construction applications. Final report, 14:30272 (R;CA)
Liquefaction
Alberta Research Council [research reports], 14:30371 (R;CA)
Alberta Research Council [research reports], 14:30372 (R;CA)
Molecular Structure
Metal arene complexes in coal structure determination: Quarterly reports, September 1988–February 1989, 14:30270 (R;US)
Petrology
Round robin tests, 1982. Petrographic analysis for a high volatile Australian coal and its liquefied residue, 14:30269 (R;CA)
Porosity
Alberta Research Council [research reports], 14:30372 (R;CA)
Public Opinion
Improving public awareness of the importance of coal and clean coal technology, 14:30283 (R;US)
Pyrolysis
Alberta Research Council [research reports], 14:30372 (R;CA)
Quantitative Chemical Analysis
Transient infrared emission spectroscopy, 14:31407 (J;US)
Research Programs
High-sulfur coal research at the SIUC Coal Technology Laboratory: Quarterly progress report, January 1–March 31, 1989, 14:30240 (R;US)
Staged Combustion
Investigation of a newly developed, multistage combustion system, 14:31580 (R;DE;In German)
Low NO/sub x//SO/sub x/ burner trials. CFB Gagetown, 14:31680 (R;CA)
Structural Chemical Analysis
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1, 1986–March 31, 1986, 14:30252 (R;US)
Supply and Demand
Canadian energy supply and demand, 1987-2005. Summary, 14:30997 (R;CA;In French)
Water Removal
Dewatering of fine coal refuse: Final report, August 1985–December 1987, 14:30273 (R;US)

COAL GASIFICATION
Hot Gas Cleanup
Multicycle testing of zinc ferrite, 14:30250 (R;US)
Yields
Industrial market assessment of the products of mild gasification: Final report, 14:30251 (R;US)

COAL GASIFICATION PLANTS
Environmental Quality
Strategy for developing environmental sampling and analysis programs at coal-gasification pilot and demonstration plants. Topical report, 14:30266 (R;US)

COAL LIQUEFACTION
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987, 14:30255 (R;US)
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986, 14:30253 (R;US)
Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986, 14:30254 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1, 1986–March 31, 1986, 14:30252 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988, 14:30258 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, April 1–June 30, 1988, 14:30259 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987, 14:30256 (R;US)
Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987, 14:30257 (R;US)
Hydrogen Transfer
Bimetallic promotion of cooperative hydrogen transfer and heteroatom removal in coal liquefaction: Quarterly technical progress report, December 1, 1988–February 28, 1989, 14:30263 (R;US)
Solvents
Improvement in coal liquefaction solvent quality by dewaxing, 14:30246 (R;US)

COAL LIQUIDS
Desulfurization
Concentration and removal of nitrogen and sulfur containing compounds from organic liquids phases using electrochemically reversed chemical complexation, 14:30268 (J;US)
Isotope Ratio
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986, 14:30253 (R;US)
Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986, 14:30254 (R;US)
Production
Batch autoclave tests for the liquefaction of Alberta subbituminous coals: I.G. Farben liquefaction process, 14:30241 (R;CA)
Liquefaction characteristics of Highvale coal in the Dow Coal Liquefaction Process, 14:30243 (R;CA)
Structural Chemical Analysis
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987, 14:30255 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988, 14:30258 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987, 14:30256 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1, 1986–March 31, 1986, 14:30252 (R;US)
Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987, 14:30257 (R;US)

COAL MINERS
Respiratory System Diseases
Pneumoconiosis in Appalachian bituminous coal miners, 14:30284 (R;US)

COAL MINES
Land Reclamation
An analysis of soil and surface properties which affect infiltration and runoff on mined lands, Centre County, Pennsylvania, 14:32025 (R;US)

COAL MINING
Geophysical Surveys
Determining geotechnical and hydrogeological parameters using downhole geophysics in the Canadian plains. Phase 1 report. A review of potential applications, vol. 1, 14:32422 (R;CA)
Mine Haulage
Demonstration and evaluation of an integrated truck management system in a producing Canadian surface coal or oil sands mine, 14:30336 (R;CA)

COAL PREPARATION
Cleaning
Technical/economic impacts and implications of using washed coals at New York State utilities. Final report, 14:30798 (R;US)

COAL-DERIVED LIQUIDS
See COAL LIQUIDS

COAL-FIRED GAS TURBINES
Design
Advanced coal-fueled gas turbine systems, Volume 2: Annual technical progress report, 14:30793 (R;US)

COAL-OIL MIXTURES
See COAL

COATED FUEL PARTICLES
Burnup
Determination of effective cross sections and burnup calculation for HTR-irradiations in a reflector position of the research reactor FRJ-2 (DIDO), 14:30845 (R;DE;In German)

Fission Product Release
Fission product release profiles from spherical HTR fuel elements at accident temperatures, 14:30906 (R;DE)

COATINGS
See also PAINTS
PROTECTIVE COATINGS

Heat Resistant Materials
Thermal-insulating coatings. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:31286 (R;US)

Magnetic Materials
Development of a magnetic coating for gas pipe detection. Final report, May 1987-June 1988, 14:30322 (R;US)

Manufacturing
An investigation into the state-of-the-art of dielectric heating applications for lamination, 14:31121 (R;CA)

Performance
Silver-coated fumed silica as a substrate material for surface-enhanced raman scattering, 14:31409 (J;US)

Radiation Curing
An investigation into the state-of-the-art of dielectric heating applications for lamination, 14:31121 (R;CA)

COBALT

Membrane Transport
Application of the pH-stat technique in Donnan dialysis: effect of anion invasion in the $CoSO_4$/Nafion 117/H_2SO_4 system, 14:31440 (J;US)

Phase Studies
Structure determination of metastable cobalt films, 14:31247 (J;US)

Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)

Solvent Extraction
Analysis of cobalt extraction by di-(2-ethylhexyl) phosphoric acid in a continuous flow stirred tank with a laser capillary spectrophotometer, 14:31421 (J;US)

COBALT 59 TARGET

Neutron Reactions
Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)

COBALT 60

Inhalation
Inhaled ^{147}Pm and/or total-body gamma radiation: Early mortality and morbidity in rats, 14:32376 (R;US)

Radioecological Concentration
25 years of reference measurements in the Karlsruhe whole-body counter: /sup 137/Cs in man, /sup 60/Co in steel, /sup 226/Ra and /sup 232/Th in paper, 14:32012 (RA;AT;In German)

COBALT ALLOYS

Catalytic Effects
Development of ternary alloy cathode catalysts for phosphoric acid fuel cells: Final report, 14:31043 (R;US)

Electronic Structure
Mössbauer spectrometry study of the hyperfine fields and electronic structure of Fe-Co alloys, 14:31251 (J;US)

Molecular Structure
Spin echo NMR of cobalt zeolite catalysts: control of particle size and structure, 14:31249 (J;US)

Passivation
An XPS study of the passivity of an amorphous Co-20P alloy, 14:31292 (BA;US)

Photoelectron Spectroscopy
An XPS study of the passivity of an amorphous Co-20P alloy, 14:31292 (BA;US)

COBALT COMPLEXES

Sorptive Properties
Dynamics of molecular hydrogen adsorbed in CoNa-A zeolite, 14:31545 (J;US)

COBALT COMPOUNDS
See also COBALT OXIDES

Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)

Molecular Structure
Spin echo NMR of cobalt zeolite catalysts: control of particle size and structure, 14:31249 (J;US)

Structural Chemical Analysis
Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene, 14:31504 (J;US)

COBALT OXIDES

Thin Films
An XPS study of the passivity of an amorphous Co-20P alloy, 14:31292 (BA;US)

COCOMBUSTION

Bench-Scale Experiments
Pilot-scale testing of a fuel oil-explosives cofiring process for recovering energy from waste explosives: Final report, 14:31901 (R;US)

COENZYME I
See NAD

COENZYMES
See also NAD

Biological Functions
S-Adenosylmethionine and the mechanism of hydrogen transfer in the lysine 2,3-aminomutase reaction, 14:32135 (BA;US)

Molecular Structure
Natural selection, protein engineering, and the last riboorganism: rational model building in biochemistry, 14:32084 (BA;US)

COFIRING
See COCOMBUSTION

COGENERATION
Development of fast-burn combustion with elevated coolant temperatures for natural gas engines. Annual report, May 1987-April 1988, 14:31165 (R;US)

Cost
Systems analyses for high-temperature fuel cells, 14:31049 (BA;US)

Rate Structure
Developing a pricing strategy: the case of nonutility generation, 14:31029 (RA;US)

COGENERATION PLANTS
See DUAL-PURPOSE POWER PLANTS

COILS (MAGNETIC)
See MAGNET COILS

COKE

Production
New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)

COLD PLASMA

Plasma Waves
Sharp boundary analysis of electrostatic flute modes, 14:32536 (J;US)

COLLECTOR PROPERTIES
See PERMEABILITY

COLLECTOR PROPERTIES (ROCKS)
See PERMEABILITY

COLLIERIES
See COAL MINES

COLLISIONLESS PLASMA

Magnetic Fields
Numerical study of gyrophase and time-dependent nonadiabatic electron losses in axially symmetric magnetic mirror fields, 14:32933 (J;US)

Mathematical Models
Waves and instabilities in noneutral plasmas, 14:32864 (R;US)

Shock Waves
Formation of double layers within an oblique collisionless shock, 14:32538 (J;US)

COLOGNE SPIRITS
See ETHANOL

COLONIES
See POPULATIONS

COLOR MODEL
Relativistic Plasma
Correlations between dilepton yields and pion multiplicities as probe of the deconfinement transition, 14:32704 (R;DE)

COLORADO
Oil Shale Processing Plants
Unocal Corporation's commercial experience in upgrading shale oil to produce a high quality syncrude, 14:30362 (RA;CN)

COLORIMETRY
See ABSORPTION SPECTROSCOPY

COLUMBIA RIVER
Fishes
Effects of variation in flow on distributions of northern squawfish in the Columbia River below McNary Dam, 14:30694 (RA;US)
Feasibility of reducing or controlling predation induced mortality of juvenile salmonids in Columbia River reservoirs, 14:30684 (RA;US)
Functional response of northern squawfish predation to salmonid prey density in McNary Tailrace, Columbia River, 14:30685 (RA;US)
Gastric evacuation in smallmouth bass (Micropterus dolomieui), 14:30683 (RA;US)
Method to directly measure maximum volume of fish stomachs or digestive tracts, 14:30696 (RA;US)
Population dynamics of northern squawfish and potential predation on juvenile salmonids in a Columbia River reservoir, 14:30688 (RA;US)
Population dynamics of walleye and smallmouth bass and potential on salmonid smolts in John Day Reservoir, 14:30689 (RA;US)
Predation by northern squawfish, walleye, smallmouth bass, and channel catfish in a mainstem Columbia River reservoir. I. Feeding ecology during the salmonid smolt out-migration, 14:30680 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part III. Abundance and distribution of northern squawfish, walleye, and smallmouth bass, 14:30686 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part IV. Estimated total loss and mortality of juvenile salmonids to northern squawfish, walleye, and smallmouth bass, 14:30687 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia River Reservoir: Part II. Consumption rates of northern squawfish, walleye, smallmouth bass, and channel catfish, 14:30681 (RA;US)
Prototype water reuse system, 14:30691 (RA;US)
Simulation of predation by a resident fish on juvenile salmonids in a Columbia River Reservoir, 14:30690 (RA;US)
Size selectivity and bias in estimates of population parameters of smallmouth bass, walleye, and northern squawfish in a Columbia River reservoir, 14:30695 (RA;US)
Use of diagnostic bones to identify and estimate original lengths of ingested prey fishes, 14:30692 (RA;US)
User's guide for RESPRED: a model of predation by resident fish on juvenile salmonids in a Columbia River reservoir, 14:30698 (RA;US)
Variation in capture efficiency of a beach seine for small fishes, 14:30693 (RA;US)
Site Surveys
A statistical analysis of measured river contamination at selected shoreline locations, 14:32053 (R;US)

COLUMBIUM
See NIOBIUM

COLUMN PACKING
Performance
Performance of spray, sieve tray, and packed contactors for high pressure extraction, 14:31453 (J;US)

COLUMNS (EXTRACTION)
See EXTRACTION COLUMNS

COLUMNS (MECHANICAL)
See MECHANICAL STRUCTURES

COMBINED GAS AND STEAM CYCLE POWER PLANTS
See COMBINED-CYCLE POWER PLANTS

COMBINED STEAM-POWER GENERATION
See COGENERATION

COMBINED-CYCLE POWER PLANTS
Performance Testing
Utilization of high-sulfur shale oil in power plant integrated with gasification system, 14:30402 (RA;CN)

COMBUSTION
See also COCOMBUSTION
Optimization
PREPP [Process Experimental Pilot Plant] rotary kiln plant performance overview, 14:30540 (R;US)

COMBUSTION CHAMBERS
Temperature Measurement
Acoustic temperature profile measurement technique for large combustion chambers, 14:31684 (J;US)

COMBUSTION KINETICS
Mathematical Models
Numerical computation of bifurcation phenomena and pattern formation in combustion, 14:31273 (R;US)

COMBUSTION PRODUCTS
Detection
Real-time measurement of the size fractionation of aerosol black carbon during the Southern California Air Quality Study, June 13–September 4, 1987, Claremont College, California, 14:31932 (R;US)
Hydrochloric Acid
Evaluation of HCl continuous-emission monitors. Final report, May 1986-May 1987, 14:31949 (R;US)
Monitoring
The potential of continuous emission monitoring of hazardous waste incinerators using Fourier transform infrared spectroscopy, 14:31919 (R;US)
Particulates
Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988, 14:31988 (R;US)
Visible Spectra
Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988, 14:31988 (R;US)
Waste Disposal
Northeast Regional Biomass Energy Program: Progress report, January 1989–March 1989, 14:30672 (R;US)

COMBUSTORS
See also FLUIDIZED-BED COMBUSTORS
Research Programs
Investigation of a newly developed, multistage combustion system, 14:31580 (R;DE;In German)
Testing
1.0 Million Btu combustor testing: Test results: Part 2, 14:30803 (R;US)

COMMERCIAL BUILDINGS
Energy Analysis
Investigation of metered data analysis methods for commercial and related buildings, 14:31071 (R;US)
Energy Conservation
Some energy-saving measures for commercial buildings, 14:31054 (R;CA)
Gas Heat Pumps
Gas-engine heat-pump system and component efficiency and reliability improvement. Phase 2 report, September 1986-January 1989, 14:31074 (R;US)
Space Hvac Systems
Development and field test of a desiccant-based air conditioning system for supermarkets. Final report, October 1983-May 1988, 14:31073 (R;US)
Market assessment for future technologies, 14:31066 (RA;US)

COMMERCIAL SECTOR
Rate Structure
Importance of market segmentation in new service and rate offerings, 14:31023 (RA;US)

COMMUNITIES (ECOLOGICAL)
See ECOSYSTEMS

COMPACTORS
Performance Testing
Results of comparison testing of the General Electric and Westinghouse-Hittman compactors, 14:30544 (RA;US)
Start-up experience and operations of an incinerator and supercompactor, 14:30489 (RA;US)

COMPARATIVE EVALUATIONS
Concretes
Building constructions using cement containing a desulfurization product, 14:31116 (R;DK;In Danish)

COMPLEXES
See also OXYGEN COMPLEXES
ZINC COMPLEXES

Chemical Preparation
Synthesis and properties of novel cluster phases: Progress report ending June 30, 1989, 14:31471 (R;US)

COMPOSITE MATERIALS
Ceramics technology: automotive gas-turbine-engine component applications. January 1976-April 1989 (Citations from the NTIS data base). Report for January 1976-April 1989, 14:31285 (R;US)

Mechanical Properties
Characterization of mechanical damage mechanisms in ceramic composite materials. Technical report, 23 May 1987-24 May 1988, 14:31314 (R;US)
Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988, 14:31175 (R;US)

Neutron Diffraction
Application of neutron diffraction to the measurement of internal residual strain in the constituents of advanced composites, 14:31316 (R;US)

Nondestructive Testing
Measured damping and modulus of composite cylinders, 14:31662 (R;US)

COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS

COMPRESSED GASES
Storage
Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report, 14:31164 (R;US)

COMPTON SPECTROMETERS
Design
Demonstration of a Time Projection Compton Spectrometer, 14:31872 (R;US)

COMPUTED TOMOGRAPHY
See COMPUTERIZED TOMOGRAPHY

COMPUTER ARCHITECTURE
Architectural considerations, software support, and compiler issues in multi-computer implementation. Final report, 5 September 1985-31 October 1988, 14:32976 (R;US)
Parallel QR factorization algorithm using local pivoting, 14:32978 (R;US)

Algorithms
The dynamical behavior of classifier systems, 14:33001 (R;US)

Meetings
Technical development of HEPVM software, Paris, Lyon, France. April 17-26, 1989: Foreign trip report, 14:32996 (R;US)

Modifications
Change Control of software at LANL, 14:33004 (R;US)

Security
Issues and approaches for electronic document approval and transmittal using digital signatures and text authentication, 14:32999 (R;US)
VMS [Virtual Memory Systems] ALAP [Audit Log Analysis Package] 1.0: An automated audit trail analysis tool, 14:33002 (R;US)

Testing
System-based component test plans and operating characteristics: Introduction and overview, 14:33009 (R;US)

COMPUTER CALCULATIONS
Environmental Impacts
Environmental aspects. Development of a computer model for environmental impact of energy production, 14:32002 (R;DK;In Danish)

COMPUTER CODES
See also A CODES
E CODES
H CODES
L CODES
M CODES
N CODES
P CODES
W CODES
Compendium of technical computer codes used in support of the DOE Office of Civilian Radioactive Waste Management, 14:30571 (R;US)
Grain-boundary modeling, 14:31235 (BA;US)

Commercialization
A view of the evolving DOE software copyright policy, 14:32987 (R;US)

Comparative Evaluations
Multicode comparison of selected source-term computer codes, 14:30569 (R;US)

F Codes
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)

I Codes
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)

M Codes
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)

COMPUTER LANGUAGES
See PROGRAMMING LANGUAGES

COMPUTER NETWORKS
Engineering Drawings
The CALS Test Network MIL-D-28000 Class II reference drawing packet: Revision C, 14:33011 (R;US)

COMPUTER PROGRAMMING
See PROGRAMMING

COMPUTER PROGRAMS
See COMPUTER CODES

COMPUTERIZED CONTROL SYSTEMS
Expert Systems
Expert-system approach to large space-systems control. Technical report, September 1987-October 1988, 14:31891 (R;US)

Performance Testing
Microprocessor environmental control in a large farrowing complex, 14:31117 (R;CA)

COMPUTERIZED TOMOGRAPHY
Communications
Status and trends of digital image transmission and image storage, 14:32321 (RA;DD;In German)
System configuration and functional characteristics of the structured Siemens picture archiving and communication systems (PACS), 14:32322 (RA;DD;In German)

Computers
Take-over of CT images by Robotron computer from Tomoscan CX, 14:32233 (RA;DD;In German)

Digital Systems
Status and trends of digital image transmission and image storage, 14:32321 (RA;DD;In German)
System configuration and functional characteristics of the structured Siemens picture archiving and communication systems (PACS), 14:32322 (RA;DD;In German)

Dosimetry
Dosimetry and radiation risk in diagnostic radiological examinations of the lumbosacral region of the spine: computerized tomography versus functional myelography, 14:32388 (RA;AT)

Evaluation
High resolution subsurface imaging with geophysical diffraction tomography, 14:32419 (R;US)
Image Processing
Grading of brain tumors by computer-aided analysis of CT images and by anamnestic data, 14:32238 (RA;DD;In German)
Procedure of the three-dimensional representation of tomographic image arrays, 14:32320 (RA;DD;In German)
Reduction of artefacts in CT diagnosis caused by metallic implants, 14:32236 (RA;DD;In German)
Quality Control
Quality control in computerized tomography, 14:32235 (RA;DD;In German)
Radiation Doses
Studies on lens and gonad radiation doses in computerized tomography, 14:32759 (RA;DD;In German)
Uses
CT system Tomoscan in clinical diagnostics as experienced in ten-month application, 14:32251 (RA;DD;In German)
Trends in development of computerized tomography and future applicability, 14:32232 (RA;DD;In German)

COMPUTERS
See also CRAY COMPUTERS
HYPERCUBE COMPUTERS
Energy Consumption
The sum of megabytes equals gigawatts: Energy consumption and efficiency of office PC's and related equipment, 14:31038 (R;US)

CONCENTRATIONS (RADIONUCLIDES)
See RADIOACTIVITY

CONCRETES
See also PRESTRESSED CONCRETE
REINFORCED CONCRETE
Ashes
Building constructions using cement containing a desulfurization product, 14:31116 (R;DK;In Danish)
Bibliographies
Fly ash in concrete. Compilation of abstracts of papers from recent international conferences and symposia on fly ash in concrete, 14:31111 (R;CA)
Compression Strength
Utilization potential of circulating fluidized bed combustion residue in construction applications. Final report, 14:30272 (R;CA)
Gamma Radiation
Back scattering coefficients for 50 to 400 kV X-rays scattered on baryt concrete, 14:32750 (RA;AT)
Mechanical Properties
Studies on strength and workability of high-strength and flowing concrete utilizing low calcium oil shale ash, 14:30407 (RA;CN)
Mechanical Tests
Utilization potential of circulating fluidized bed combustion residue in construction applications. Final report, 14:30272 (R;CA)
Porosity
Tritium penetration through concrete, 14:30618 (J;US)
Radionuclide Migration
Tritium penetration through concrete, 14:30618 (J;US)
Testing
Design and construction of automated freeze-thaw testing equipment for concrete. Final report, 14:31663 (R;CA)
Ultrasonic Testing
Development of cementitious grouts for post-tensioned concrete members use in offshore structures and in the arctic environment. Vol. 3, Evaluation of pulse-echo technology for detection of voids in grouted ducts, 14:31664 (R;CA)
Waste Product Utilization
Studies on strength and workability of high-strength and flowing concrete utilizing low calcium oil shale ash, 14:30407 (RA;CN)

CONDENSED AROMATICS
See also ANTHRACENE
BENZOPYRENE
NAPHTHALENE
PERYLENE
TRIPHENYLENE
Electron Transfer
Photoinduced electron transfer and back transfer in systems of randomly distributed donors and acceptors: picosecond transient grating experiments, 14:31556 (J;US)
Photolysis
Phototransformations of benzopyranols and related systems. Steady-state and laser flash photolysis studies, 14:31555 (J;US)
Solvent Properties
Selective extraction of Cu^{2+} and Ag^{+} ions from sulfuric acid by synergistic combinations of tetradentate thia macrocycles with didodecylnaphthalene sulfonic acid, 14:31417 (J;US)
Synergistic solvent extraction of manganese by macrocyclic crown ethers in combination with didodecylnaphthalene sulfonic acid: effect of macrocycle substituents, 14:31416 (J;US)

CONDENSERS (ELECTRIC)
See CAPACITORS

CONDUCTIVITY (THERMAL)
See THERMAL CONDUCTIVITY

CONDUCTORS (ELECTRIC)
See ELECTRIC CONDUCTORS

CONIFERS
Biological Stress
Defoliation of coniferous trees. Assessments 1984-1987, 14:32401 (R;SE)

CONSERVATION (ENERGY)
See ENERGY CONSERVATION

CONSOLIDATED FUEL REPROCESSING PROGRAM
Criticality experiments with a mixed oxide fuel pin array in plutonium-uranium nitrate solutions, 14:30440 (R;US)

CONTACT RADIOTHERAPY
See RADIOTHERAPY

CONTACTORS
See SWITCHES

CONTAINERS
See also CASKS
PRESSURE VESSELS
REACTOR VESSELS
Corrosion
Gamma irradiation and in-situ corrosion studies on unalloyed steels for a high level waste packaging in a rock salt repository, 14:30566 (R;DE)
Decontamination
Model predictions of glass fracturing in canisters during decontamination, 14:30520 (RA;US)
High-Level Radioactive Wastes
Gamma irradiation and in-situ corrosion studies on unalloyed steels for a high level waste packaging in a rock salt repository, 14:30566 (R;DE)
Standards
An analysis of the background and development of regulations for the air transport of plutonium in the USA, 14:30596 (R;US)
Testing
Design verification testing, 14:30591 (R;US)

CONTAINMENT
See also CONTAINMENT BUILDINGS
Design
A new glove-box system for a high-pressure tritium pump, 14:31624 (J;US)

CONTAINMENT BUILDINGS
Impact Strength
Vibration transmission behaviour of reinforced concrete components under extreme impact stresses, 14:30922 (R;DE;In German)

CONTAMINATION
Dissolution
The effect of precipitation on contaminant dissolution and transport: Analytic solutions, 14:30567 (R;US)
Mass Transfer
The effect of precipitation on contaminant dissolution and transport: Analytic solutions, 14:30567 (R;US)

CONTAMINATION (INTERNAL)
See RADIONUCLIDE KINETICS

CONTRACTORS
Management
Annual procurement and financial report, FY 1988, 14:32967 (R;US)
CONTRAST MEDIA
Optimization
Optimization of Magnevist doses in NMR imaging of brain tumors, 14:32338 (RA;DD;In German)
Organic Iodine Compounds
Nephrotoxicity of high doses of contrast media in humans, 14:32274 (RA;DD)
CONTROL (RADIOACTIVITY)
See RADIATION MONITORING
CONTROL ELEMENTS
Design
Hydraulic control rod drive for water-cooled nuclear reactors, particularly heating reactors, 14:30825 (TG;US)
CONTROL RODS
See CONTROL ELEMENTS
CONTROL THEORY
Numerical Analysis
Issues in the sequential deployment of strategic defenses, 14:31900 (R;US)
CONVERTERS (DIGITAL-ANALOG)
See DIGITAL-TO-ANALOG CONVERTERS
COOLERS
See HEAT EXCHANGERS
COOLING SYSTEM (REACTOR)
See REACTOR COOLING SYSTEMS
COOLING SYSTEMS
See also REACTOR COOLING SYSTEMS
Absorption Refrigeration Cycle
Cost reduction in absorption chillers: Phase 2, 14:31056 (R;US)
Dehumidification
Testing of novel desiccant materials and dehumidifier matrices for desiccant cooling applications, 14:31092 (R;US)
COOLING TIME
Mathematical Models
Comparison of analysis methods for burnup credit applications, 14:30588 (R;US)
COOLING WATER CHEMICAL TREATMENT
See WATER CHEMISTRY
COPPER
Barium
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Corrosion Inhibitors
Atmospheric corrosion inhibition, 14:31666 (BA;US)
Crystal Structure
Discrete and continuous disorder in superlattices, 14:31263 (J;US)
Electronic Structure
Relativistic effects in the electronic structure of Cu{001}, 14:31260 (J;US)
Interfaces
High-resolution electron microscopy of metal/ceramic interfaces, 14:31186 (R;US)
Membrane Transport
Supported liquid membrane separation of aluminum from copper leaching liquors, 14:31431 (J;US)
Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)
Separation Processes
Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)
Sorptive Properties
Near-infrared surface-enhanced Raman spectroscopy. Part I: Copper and gold electrodes, 14:31356 (J;US)
Superconductors
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Total Cross Sections
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
X Radiation
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
X-Ray Spectra
Extended x-ray-absorption fine-structure study of copper under high pressure, 14:31256 (J;US)
Yttrium Oxides
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
COPPER 63 TARGET
Neutron Reactions
Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)
Proton Reactions
Peaks in the valley: Searching for resonances in large angle exclusive scattering, 14:32565 (J;US)
COPPER 67
Labelling
Copper-67 labeled porphyrin localization in inflamed tissues, 14:32349 (R;US)
COPPER ALLOYS
See also MONEL 400
Atomic Models
Alloy models with the embedded-atom method, 14:31257 (J;US)
Electrical Properties
Microscopic real-space approach to the theory of metallic glasses, 14:31248 (J;US)
Solution Heat
Alloy models with the embedded-atom method, 14:31257 (J;US)
COPPER CHLORIDES
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
COPPER COMPLEXES
Reactions of low-valent transition-metal complexes with hydrogen peroxide. Are they Fenton-like or not? 1. The case of Cu^{+}_{aq} and Cr^{2+}_{aq}, 14:31501 (J;US)
COPPER COMPOUNDS
See also COPPER OXIDES
COPPER SULFIDES
CUPRATES
Cuprates
Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988, 14:31266 (R;US)
Dissolution
Monolayer behavior of hydroxyoxime extractants, 14:31419 (J;US)
Solvent Extraction
Selective extraction of Cu^{2+} and Ag^{+} ions from sulfuric acid by synergistic combinations of tetradentate thia macrocycles with didodecylnaphthalene sulfonic acid, 14:31417 (J;US)
COPPER OXIDES
Catalytic Effects
Analytical electron microscopy of catalyst promoters, poisons, and active species: Progress report, [July 1986–September 1988], 14:31470 (R;US)
Chemical Vapor Deposition
Chemical vapor deposition of $YBa_2Cu_3O_{7-x}$ superconducting films, 14:31296 (J;US)
Compacting
Observation of crystallographic texture and J/sub c/ anisotropy in bulk shock-compacted YBa/sub 2/Cu/sub 3/O/sub 7-x/ powders, 14:31297 (J;US)
Crystal Structure
X-ray study of in-plane epitaxy of $YBa_2Cu_3O_x$ thin films, 14:31311 (J;US)
Crystal-Phase Transformations
Structural phase transformations and superconductivity in $La_{2-x}Ba_xCuO_4$, 14:31303 (J;US)

Electric Conductivity
Fluctuation conductivity of Tl-Ba-Ca-Cu-O thin films, 14:31310 (J;US)
Electrodynamics
Nonlinear electrodynamics in the granular superconductor $YBa_2Cu_3O_7$: Experiments and interpretation, 14:31307 (J;US)
Electronic Structure
Assessment of Fermi-liquid description for the normal state of high-T_c superconductors, 14:32818 (J;US)
Photoemission spectroscopy of single crystal HTSC materials: A Fermi liquid electronic structure, 14:31393 (R;US)
Magnetization
Flux creep in $Y(Gd)Ba_2Cu_3O_{7-\delta}$: Magnetic field dependence, 14:31306 (J;US)
Microstructure
The study of structure-processing-property relations in copper oxide-based high T_c superconductors: Progress report, July 1, 1988–March 1, 1989, 14:31278 (R;US)
Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)
Physical Properties
Preparation and Raman analysis of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$, 14:31312 (J;US)
Sorptive Properties
Characterization and fundamental studies on CuO sorbent materials to determine attrition mechanisms on substrate gamma alumina: Technical progress report No. 9, September 23, 1988–December 23, 1988, 14:30804 (R;US)
Specific Heat
Low-temperature specific heat of single-crystal $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$, 14:31313 (J;US)
Specific heat of $Bi_2Sr_2CuO_6$ and $Bi_2Sr_2CaCu_2O_8$ in the superconducting state, 14:31309 (J;US)
Superconductivity
Composition of superconducting $La_2CuO_{4+\delta}$: A superconductor doped by excess oxygen defects, 14:31270 (R;US)
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)
Transition Temperature
Pressure dependence of the superconducting and Neel temperatures in a $La_2CuO_{4+\delta}$ crystal, 14:31305 (J;US)
X-Ray Spectra
Distorted chain sites for Co- and Fe-substituted $YBa_2Cu_3O_{7-\delta}$, 14:31308 (J;US)

COPPER SULFIDES
Crystal Structure
Structural and NMR study of the lithiated defect thiospinels $Li_xCu_{0.07}[Ti_2]S_4$ ($0 < x < 2$), 14:31481 (J;US)

COPPER VAPOR LASERS
See GAS LASERS

CORES (DRILL)
See DRILL CORES

CORES (REACTOR)
See REACTOR CORES

CORIUM
C Codes
Validation of core debris/concrete interactions and source term models, 14:30921 (R;US)

CORONA DISCHARGES
Biological Effects
Identification of ions near HVDC [high-voltage direct-current] transmission lines: Final report, 14:32403 (R;US)

CORTEX (ADRENAL)
See ADRENAL GLANDS

COSMIC GAMMA BURSTS
Data Analysis
Gamma ray bursts: Confrontation between theory and observational data, 14:32464 (R;US)

COSMIC NEUTRINOS
Cosmic Ray Flux
Flux of atmospheric neutrinos, 14:32471 (J;US)

COSMIC PARTICLES
See COSMIC RADIATION

COSMIC RADIATION
See also COSMIC NEUTRINOS
Solar-Geophysical Data Number 438, February 1981. Part 2 (comprehensive reports). Data for August 1980 and miscellanea, 14:32461 (R;US)
Acceleration
Computer simulations of cosmic-ray diffusion near supernova remnant shock waves, 14:32463 (R;US)
Mathematical Models
Comment on "Reheated Universe by unstable neutrinos", 14:32466 (J;US)
Modulation
Solar-cycle dependence of the radial gradient of cosmic-ray intensity. Progress report for period ending 1988, 14:32441 (R;US)
Radiation Doses
Astronaut radiation exposure in low-earth orbit. Part 1. Galactic cosmic radiation, 14:32366 (R;US)
Contributions to the plenary meeting of cospar (Committee on Space Research) (27th) held in Helsinki, Finland 18-29 July 1988, 14:32365 (R;US)
Transport Theory
Equations of cosmic-ray transport with distributed acceleration, 14:32443 (R;US)

COSMOLOGICAL CONSTANT
Einstein Field Equations
Fifth force, sixth force and all that. A theoretical (classical) approach, 14:32821 (R;IT)

COSMOLOGICAL MODELS
Quantization
Consistency of quantum cosmology for models of plane symmetry, 14:32468 (J;US)
Renormalization
Inflation in a renormalizable cosmological model and the cosmic no-hair conjecture, 14:32467 (J;US)

COST BENEFIT ANALYSIS
O Codes
ORMONTE: A PC code for cost/risk analysis, 14:32983 (R;US)

COST RECOVERY
Planning
Learning the value of VE, 14:32973 (R;US)

COULOMETRY
See VOLTAMETRY

COUNTY BUILDINGS
See PUBLIC BUILDINGS

COURT BUILDINGS
See PUBLIC BUILDINGS

CP INVARIANCE
Wormhole solution to the strong *CP* problem, 14:32621 (J;US)

CRAB NEBULA
Gamma Detection
Detection of very high energy γ-rays from the Crab nebula, 14:32462 (R;US)
Mathematical Models
Spectra of crab-like pulsars: A GRO perspective, 14:32459 (R;US)

CRACK GROWTH
See CRACK PROPAGATION

CRACK PROPAGATION
Stress Analysis
Stress induced microcrack geometry at failure in unconfined and confined axial compressive tests, 14:32432 (R;US)

CRAY COMPUTERS
Computer Architecture
Attaching IBM-compatible 3380 disks to Cray X-MP, 14:32986 (R;US)
Programming Languages
Xcl—A family of programming lanquage-based shells, 14:33003 (R;US)

CRITICAL GROUP (ICRP)
See ICRP CRITICAL GROUP

CROPS
Drying
Development of technology to utilize existing tobacco kilns and/or tobacco storage barns for curing (drying) and/or storage of other crops, 14:31118 (R;CA)
CROWN ETHERS
See POLYETHYLENE GLYCOLS
CRUDE CARRIERS
See TANKER SHIPS
CRUDE OIL
See PETROLEUM
CRYOGENIC FLUIDS
Fluid Mechanics
Program CICC, flow and heat transfer in cable-in-conduit conductors: Equations and verification, 14:31617 (R;US)
CRYOGENICS
Design
Cryogenic techniques for large superconducting magnets in space, 14:31599 (R;US)
CRYOGENS
See CRYOGENIC FLUIDS
CRYPTOGRAPHY
Prepositioned shared secret and/or shared control schemes, 14:33022 (R;US)
CRYSTAL GROWTH
Electrical Properties
Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE), 14:32789 (RA;BR)
Magnetic Fields
Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE), 14:32789 (RA;BR)
Mathematical Models
Thermal-capillary model with axisymmetric fluid flow for analysis of Czochralski crystal growth of high Prandtl number materials: Final report, 14:31337 (R;US)
Substrates
Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE), 14:32789 (RA;BR)
CRYSTAL STRUCTURE
Crystal Growth
InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)
Optical investigation of atomic steps in ultra-thin InGaAs/InP quantum wells grown by vapor levitation epitaxy, 14:31230 (R;BR)
Photoluminescence
InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)
Optical investigation of atomic steps in ultra-thin InGaAs/InP quantum wells grown by vapor levitation epitaxy, 14:31230 (R;BR)
CRYSTALLINE ROCKS
See IGNEOUS ROCKS
METAMORPHIC ROCKS
CUPRATES
Superconductivity
Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988, 14:31266 (R;US)
CURIUM
Solvent Extraction
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)
CURIUM ISOTOPES
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
CYANIDES
See also HYDROCYANIC ACID
Adsorption
Kinetic studies of cadmium and ferricyanide adsorption on goethite, 14:32048 (J;US)
Photochemical Reactions
Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces, 14:31524 (J;US)
CYANOBACTERIA
Electron Spin Resonance
Site-directed mutagenesis identifies a tyrosine radical involved in the photosynthesized oxygen-evolving system, 14:32196 (J;US)
CYCLIC ESTERS
See LACTONES
CYCLOALKENES
Decomposition
High temperature deviations from Rice–Ramsberger–Kassel–Marcus unimolecular rate coefficients expressions, 14:31480 (J;US)
CYCLOHEXANE
C-H insertion and π-complex formation reactions of (η^5-C_5Me_5)(PMe_3)Ir with ethylene: an intra- and intermolecular isotope effect study, 14:31525 (J;US)
Dehydrogenation
Studies on a membrane reactor, 14:31490 (J;US)
Hydroxylation
Biomimetic catalysis: Hydroxylation of C_2, C_3, and cycloC_6 hydrocarbons by managanese porphyrin and non-porphyrin catalysts in the presence of monooxygen transfer reagents, 14:30706 (R;US)
CYCLOHEXYLENEDINITRILOTETRAACETIC ACID
See CDTA
CYCLOTRONS
Biological Shielding
Shielding of low-energy cyclotrons, 14:31700 (RA;AT;In German)
Exhaust Systems
Radiation protection requirements on exhaust air installations of low-energy particle accelerators, 14:31698 (RA;AT;In German)
CYSTS
Computerized Tomography
CT-aided punctures in cerebral and spinal cystic processes, 14:32241 (RA;DD;In German)
CYTOCHROMES
Nuclear Magnetic Resonance
Changes in Rhodospirillum rubrum cytochrome c_2 and subsequent renaturation: An ^{15}N NMR study, 14:32356 (J;US)

D

D* PLUS RESONANCES
See BARYONS
D* ZERO RESONANCES
See BARYONS
D*-2010 MESONS
Radiative Decay
Radiative meson decays—an algebraic approach, 14:32601 (J;US)
D*RESONANCES
See BARYONS
D-1285 RESONANCES
See F1-1285 MESONS
D-2007 RESONANCES
See D*-2010 MESONS
DAMS
Environmental Impacts
Kokanee stock status and contribution Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho: Annual progress report FY 1988, 14:30679 (R;US)

Tracer Techniques
Investigation of seepage under the Wenxiakou dam using radiotracer, 14:31992 (RA;XA)

DANUBE RIVER
Radioactivity
Radioecological investigations in the Austrian part of the Danube river, 14:32073 (RA;AT)
Radiological analysis of the upper Danube river system -a 20 years research programme, 14:32072 (RA;AT;In German)
Radiology
Radiological analysis of the upper Danube river system -a 20 years research programme, 14:32072 (RA;AT;In German)

DATA ACQUISITION SYSTEMS
Design
Sandia's UGT Instrumentation Development Program: IN-WET'89 Paper No. 15, 14:31876 (R;US)
Performance
MPS [Multiparticle Spectrometer] data acquisition software system, 14:31804 (R;US)

DATA BASE MANAGEMENT
Expert Systems
An expert system to facilitate selecting a database management system, 14:32989 (R;US)
Operation
Data Inventory System (DIS): A user's guide and programmer's manual, 14:33021 (R;US)

DATA PROCESSING
See also TASK SCHEDULING
Computer Codes
PIPE-LINE feature implementation on RSx11M operating system, 14:32997 (R;SU;In Russian)
Least Square Fit
Approximation of experimental dependences by two-support method, 14:33000 (R;SU;In Russian)
P Codes
Approximation of experimental dependences by two-support method, 14:33000 (R;SU;In Russian)
Statistics
Error estimates on averages of correlated data, 14:33005 (R;DK)

DATA TRANSMISSION SYSTEMS
Fiber Optics
Radiation effects on fiberoptic signal transmission systems, 14:30864 (RA;US)

DATA-FLOW PROCESSING
Using control states for parallelism extraction. Final report, 1 March 1987-30 June 1988, 14:32979 (R;US)

DATING
See AGE ESTIMATION

DAUGHTER PRODUCTS
Radioecological Concentration
Evaluation of the performance characteristics of radon and radon-daughter concentration measurement devices under controlled environmental conditions, 14:30705 (R;US)

DAYGLOW
See AIRGLOW

DC TO AC INVERTERS
See INVERTERS

DEBRIS (NUCLEAR)
See FISSION PRODUCTS

DECALSO
See ION EXCHANGE MATERIALS

DECAY PRODUCTS
See DAUGHTER PRODUCTS

DECIMETER WAVE RADIATION (1-3 DM)
See RADIOWAVE RADIATION

DECIMETER WAVE RADIATION (3-10DM)
See RADIOWAVE RADIATION

DEFECTS
Evaluation
Evaluation of elastic-plastic surface flaw behavior and related parameters using surface displacement measurements, 14:31195 (R;US)

DEFENSE
See NATIONAL DEFENSE

DEFORMATION
See also NUCLEAR DEFORMATION
Alloy-Zr98Sn-4
Influences of deformation velocity and temperature on localized deformation of zircaloy-4 in tensile tests, 14:31209 (R;BR;In Portuguese)
Equations
Verification of constitutive equations for application at 850/sup 0/C, using the internal stress concept, 14:31214 (R;DE;In German)
Finite Element Method
Local isotropic/global orthotropic finite element technique for modeling the crush of wood in impact limiters, 14:31614 (R;US)
Temperature Dependence
Influences of deformation velocity and temperature on localized deformation of zircaloy-4 in tensile tests, 14:31209 (R;BR;In Portuguese)
Time Dependence
Radiation effects on time-dependent deformation: Creep and growth, 14:31224 (R;US)
Velocity
Influences of deformation velocity and temperature on localized deformation of zircaloy-4 in tensile tests, 14:31209 (R;BR;In Portuguese)

DEHYDROGENASES
See OXIDOREDUCTASES

DELAYED RADIATION INJURIES
See RADIATION INJURIES

DELETIONS (CHROMOSOMAL)
See CHROMOSOMAL ABERRATIONS

DELTA RESONANCES (MESON)
See MESONS

DELTA-1232 BARYONS
Lagrangian Field Theory
Problems of describing spin-(3/2 baryon resonances in the effective Lagrangian theory, 14:32603 (J;US)

DELTA-1236 RESONANCES
See DELTA-1232 BARYONS

DELTA-966 RESONANCES
See A0-980 MESONS

DEMOCRITUS REACTOR
Loss Of Flow
Assessment of the consequences of a research reactor credible accident release, 14:30913 (RA;AT)

DENMARK
Energy Policy
Energy planning 1988. Status report, 14:30999 (R;DK;In Danish)
Statement on energy policy 1988. Statement by the Ministry of Energy on laws concerning energy policy measures and Danish Oil and Natural Gas A/S, 14:31000 (R;DK;In Danish)
Research Programs
The Danish aquifer thermalenergy storage program, 14:30944 (RA;CA;In English and French)
Seasonal Thermal Energy Storage
Groundwater heat pumps in combination with low-temperature natural heat sources. Economical and technical aspects, 14:30953 (RA;CA;In English and French)
Potential for seasonal storage of industrial surplus heat, 14:30939 (RA;CA;In English and French)
Waste Heat Utilization
Potential for seasonal storage of industrial surplus heat, 14:30939 (RA;CA;In English and French)

DENSITY (CHARGE)
See CHARGE DENSITY

DENSITY (ELECTRON)
See ELECTRON DENSITY

DENTISTRY
Hazardous Materials
Health-hazard evaluation determination report No. 76-6-294, J. A. Devine, D.D.S., Cheyenne, Wyoming, 14:31963 (R;US)

DEOXYCYTIDINURIA
See URINE

DEOXYPENTOSE NUCLEIC ACID
See DNA

DEOXYRIBONUCLEIC ACID
See DNA
DEOXYRIBOSE
Chromatography
Evaluation of micellar electrokinetic capillary chromatography for the separation and detection of normal and modified deoxyribonucleosides and deoxyribonucleotides, 14:31444 (J;US)
DEPARTMENT OF DEFENSE
See US DOD
DEPLETION (ISOTOPIC)
See ISOTOPE SEPARATION
DEPLETION (NUCLEAR FUELS)
See BURNUP
DEPOLARIZATION
Beam Shaping
Depolarization enhancement due to the energy spread, 14:31719 (R;FR)
Prediction Equations
Depolarization enhancement due to the energy spread, 14:31719 (R;FR)
DEPOSITION
Federal Republic Of Germany
Analysis of dispersion and deposition of acidifying and phytotoxic air pollutants, 14:31928 (R;DE;In German)
Forecasting
Illustrative emission reduction scenarios, 14:31922 (R;US)
Nitrogen Oxides
Analysis of dispersion and deposition of acidifying and phytotoxic air pollutants, 14:31928 (R;DE;In German)
Quantitative Chemical Analysis
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
Sampling
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
Sulfur Dioxide
Analysis of dispersion and deposition of acidifying and phytotoxic air pollutants, 14:31928 (R;DE;In German)
DESERTRON
See SUPERCONDUCTING SUPER COLLIDER
DESICCANTS
Materials Testing
Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems, 14:30758 (R;US)
Performance Testing
Testing of novel desiccant materials and dehumidifier matrices for desiccant cooling applications, 14:31092 (R;US)
DESIGN
Mathematical Models
Modeling the design and operations of the federal radioactive waste management system, 14:30523 (R;US)
Standards
Yucca Mountain Project waste package design for MRS [Monitored Retrievable Storage] system studies, 14:30610 (R;US)
DESOXYRIBONUCLEIC ACID
See DNA
DESTRUCTIVE TESTING
Gas Analysis
EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)
DETONATIONS
Fiber optic sensing in a high explosives environment, 14:31874 (R;US)
Computerized Simulation
High explosives reaction model and its application to booster performance, 14:31894 (R;US)
S Codes
Shock initiation modeling of multicomponent explosives, 14:31893 (R;US)
Shock Waves
Modeling two-dimensional detonations with detonation shock dynamics, 14:32533 (J;US)
DETONATORS
Testing
Standardized piezoelectric polymer (PVDF) gauge for detonator response measurement, 14:31892 (R;US)
DEUTERIUM
Adsorption
Rotational states of H_2, HD, and D_2 on graphite, 14:31369 (J;US)
Isotope Effects
C-H insertion and π-complex formation reactions of $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir$ with ethylene: an intra- and intermolecular isotope effect study, 14:31525 (J;US)
Isotopic Exchange
Production of the nitromethane aci ion by static high pressure, 14:31539 (J;US)
Muon-Catalyzed Fusion
Three-body molecular formation in muon-catalyzed *d-t* fusion: The role of configuration mixing, 14:32519 (J;US)
Rotational States
Rotational states of H_2, HD, and D_2 on graphite, 14:31369 (J;US)
DEUTERIUM COMPOUNDS
Chemical Reactions
Isotopic dependence of recombination kinetics in water, 14:31573 (J;US)
Temperature dependence of the rate constants of the reactions of OH radicals with C_2H_2 and C_2D_2 at 1 atm in Ar and from 333 to 1273 K, 14:31528 (J;US)
Oxidation
Mechanistic aspects of the photooxidation of water at the n-TiO_2/aqueous interface: optically induced transients as a kinetic probe, 14:31564 (J;US)
Structural Chemical Analysis
Vibrational spectra and normal-coordinate analysis of tris(bipyridine)ruthenium(II), 14:31522 (J;US)
DEUTERIUM HYDRIDE
See HYDROGEN DEUTERIDE
DEUTERIUM OXIDES
See HEAVY WATER
DEUTERIUM TARGET
Polarization
The development of a laser-driven spin-polarized dieuterium target, 14:31733 (R;US)
DEUTERIUM-LITHIUM HIGH FLUX NEUTRON SOURCE FACILITY
See NEUTRON SOURCE FACILITIES
DEUTERON BEAMS
Uranium
M-subshell ionization of U by light ion bombardment, 14:32499 (RA;BR)
DEUTERON REACTIONS
Angular Distribution
Processes of inelastic collision of composite particles with nonspherical nuclei, 14:32736 (R;SU;In Russian)
Breakup Reactions
Processes of inelastic collision of composite particles with nonspherical nuclei, 14:32736 (R;SU;In Russian)
DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
DEUTERON REACTIONS
DEUTERONS
Attenuation
Shielding of low-energy cyclotrons, 14:31700 (RA;AT;In German)
Diffusion
Diffusion of tritons, deuterons, and protons in $LiNbO_3$ crystals, 14:31366 (J;US)
Thermonuclear Reactions
Influence of attractive interaction between deuterons in Pd on nuclear fusion, 14:32703 (R;US)
DEVELOPING COUNTRIES
See also BRAZIL
DOMINICAN REPUBLIC
JORDAN
MOROCCO
PHILIPPINES
REPUBLIC OF KOREA
TURKEY

Electric Power
Power shortages in developing countries: magnitude, impacts, solutions, and the role of the private sector: a report to Congress, 14:31033 (R;US)
Energy Demand
An end-use approach to development of long-term energy demand scenarios for developing countries, 14:30996 (R;US)
Hydrogen Production
Fuel cells for extraterrestrial and terrestrial applications, 14:31053 (J;US)
Industrial Plants
Report of the Office of Energy. Project evaluation and implementation, 14:30993 (R;US)
Transportation Systems
Transportation planning and automated guideways. Transportation research record, 14:31103 (R;US)

DEWATERING EQUIPMENT
Design
Development of the electroacoustic dewatering (EAD) process for fine/ultrafine coal: Second quarterly progress report period ending 31 March 1989, 14:30239 (R;US)

DIABETES MELLITUS
Computerized Tomography
Findings in diabetics examined by computed tomography, 14:32254 (RA;DD)
Pathogenesis
Conformational basis of the receptor-binding potency of normal and mutant insulin molecules with relevance to the pathophysiology of noninsulin dependent diabetes mellitus (NIDDM), 14:32184 (BA;US)

DIAGNOSIS
Comparative Evaluations
Comparison of imaging procedures in the diagnosis of expanding processes of the liver, 14:32222 (RA;DD;In German)

DIAGNOSTIC TECHNIQUES
See also BIOMEDICAL RADIOGRAPHY
BIOPSY
NMR IMAGING
TOMOGRAPHY
Optimization
Copper-67 labeled porphyrin localization in inflamed tissues, 14:32349 (R;US)

DIAMINOBIPHENYL
See BENZIDINE

DIAMINOCAPROIC ACID
See LYSINE

DIAMONDS
Chemical Vapor Deposition
Thermodynamics and high temperature chemistry of the chemical vapor deposition of diamond films, 14:31318 (R;US)
Energy-Loss Spectroscopy
Electron Energy-Loss Spectroscopy: Fundamentals and applications in the characterization of minerals, 14:31394 (R;US)
Mechanical Properties
Determination of the mechanical properties of diamond and diamond-like films by the ultra-low load indentation technique, 14:31317 (R;US)
Structural Chemical Analysis
Microanalytical and structural characterization of optical materials by electron microscopy and related spectroscopies, 14:31283 (R;US)
Thin Films
Barriers to the nucleation of methyl groups on the diamond (111) surface, 14:31332 (R;US)

DIBARYON RESONANCES
See DIBARYONS

DIBARYONS
See also LAMBDA-N-2130 DIBARYONS
Particle Models
Inevitable dibaryons, 14:32599 (J;US)
Physical Properties
Summary of the hybrids and exotics sessions, 14:32568 (J;US)

DICHLOROMETHANE
See METHYLENE CHLORIDE

DIELECTRIC PROPERTIES
Measuring Methods
Dielectric measurements of selected ceramic materials at 245 ghz, 14:31267 (R;US)

DIENES
See also FERROCENE
Structural Chemical Analysis
High-pressure spectroscopic studies of ferrocene, nickelocene, and ruthenocene, 14:31503 (J;US)
Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene, 14:31504 (J;US)
Thermodynamic Properties
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)

DIESEL ENGINES
Exhaust Gases
Derivation of the brake-specific ventilation equation and on operating load factor expression relevant to the use of diesel machinery underground, 14:31917 (R;CA)
Exhaust Systems
Analysis and in-cylinder measurement of particulate radiant emissions and temperature in a direct-injection diesel engine, 14:31156 (R;US)
Protective Coatings
Thermal-barrier coatings: coating methods, performance, and heat-engine applications. July 1982-April 1989 (Citations from the EI Engineering Meetings data base). Report for July 1982-April 1989, 14:31222 (R;US)

DIESEL FUELS
Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988, 14:31098 (R;US)
Production
New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)
Upgrading Julia Creek shale oil - syncrude or fully refined products, 14:30363 (RA;CN)

DIESEL OIL (FRACTION)
See DIESEL FUELS

DIFFRACTION (X-RAY)
See X-RAY DIFFRACTION

DIFFUSION
See also THERMAL DIFFUSION
Mathematical Models
Radon generation, adsorption, absorption, and transport in porous media, 14:31062 (R;US)

DIFFUSION BARRIERS
Permeability
Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)

DIGESTER GAS
See METHANE

DIGESTIVE SYSTEM
See also BILIARY TRACT
ESOPHAGUS
LIVER
PANCREAS
PHARYNX
Measuring Methods
Method to directly measure maximum volume of fish stomachs or digestive tracts, 14:30696 (RA;US)

DIGESTIVE SYSTEM DISEASES
See also LIVER CIRRHOSIS
Computerized Tomography
Contribution of computerized tomography to estimating severity of acute pancreatitis, 14:32253 (RA;DD;In German)

DIGITAL SYSTEMS
Fluctuations
Fluctuations and accuracy of a digital exposure ratemeter, 14:31834 (RA;AT)
Images
Digital-image archiving systems in diagnostic radiology: picture-archiving and communication systems. January 1975-April 1989 (Citations from the INSPEC: Information Services for the

Physics and Engineering Communities data base). Report for January 1975-April 1989, 14:32353 (R;US)
DIGITAL-TO-ANALOG CONVERTERS
Design
A hybrid 3 Gs/s, 6-bit digital to analog converter, 14:31678 (R;US)
1,2-DIHYDROXYBENZENE
See PYROCATECHOL
1,3-DIHYDROXYBENZENE
See RESORCINOL
DIHYDROXYBENZENE-META
See RESORCINOL
DIHYDROXYBENZENE-ORTHO
See PYROCATECHOL
DIMETHYL KETONE
See ACETONE
DINITROSORESORCINOL
See CHLORINS
DIODES (SEMICONDUCTOR)
See SEMICONDUCTOR DIODES
DIOLS
See GLYCOLS
DIPHENYL KETONE
See BENZOPHENONE
DIPHENYLPHOSPHINE OXIDE
See ORGANIC PHOSPHORUS COMPOUNDS
DIRAC EQUATION
Boundary Conditions
Electron in an external magnetic field: boundary conditions, anomaly and index, 14:32630 (R;SU;In Russian)
Magnetic Fields
Electron in an external magnetic field: boundary conditions, anomaly and index, 14:32630 (R;SU;In Russian)
Matrix Elements
Relativistic multipole operators for semileptonic weak and electromagnetic nuclear reactions, 14:32602 (J;US)
DIRAC MONOPOLES
See MAGNETIC MONOPOLES
DIRECTED-ENERGY WEAPONS
Sizing
Constellation sizing for modest directed energy platforms, 14:33027 (R;US)
Uses
Directed energy weapons–lasers: Ground- and space-based systems, 14:33026 (R;US)
DISARMAMENT
See ARMS CONTROL
DISCHARGES (IONIZATION)
See IONIZATION
DISCHARGES (WASTES)
See WASTE DISPOSAL
DISINTEGRATION (FISSION)
See FISSION
DISKS (MAGNETIC)
See MAGNETIC DISKS
DISLOCATIONS
Shielding
The stress state close to a crack tip shielded by a dislocation array, 14:31246 (J;US)
DISPERSANTS (CHEMICAL)
See SURFACTANTS
DISPERSION RELATIONS
Computerized Simulation
A computer program for simulating the atmospheric dispersion of UF_6 and other reactive gases having positive, neutral, or negative buoyancy, 14:31907 (R;US)
DISPERSION THEORY
See DISPERSION RELATIONS
DISPLACEMENT FLUIDS
Fluid Flow
An experimental study to determine the relative influence of fluid-fluid interactions and media heterogeneities on the growth of immiscible viscous fingers, 14:30289 (R;US)
DISPOSAL (WASTES)
See WASTE DISPOSAL
DISSOLVED MATERIALS
See SOLUTES
DISSOLVED OXYGEN
See OXYGEN
DISTILLATES
See also PETROLEUM DISTILLATES
Isotope Ratio
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986, 14:30253 (R;US)
Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986, 14:30254 (R;US)
Refining
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
Structural Chemical Analysis
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987, 14:30255 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988, 14:30258 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987, 14:30256 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1, 1986–March 31, 1986, 14:30252 (R;US)
Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987, 14:30257 (R;US)
DISTILLATION
Mathematical Models
Convergence characteristics of augmented Hessian models for separations, 14:31422 (J;US)
DISTRICT COOLING
Feasibility Studies
Buffalo district heating and cooling system: technical and economic assessment. Final report, 14:31150 (R;US)
DISTRICT HEATING
See also GEOTHERMAL DISTRICT HEATING
Design
Comparative evaluation of hot water and steam distribution systems for district heating. Summary, 14:31139 (R;CA)
Comparative evaluation of hot water and steam distribution systems for district heating. Final report, 14:31138 (R;CA)
Efficiency
Optimization of the total efficiency of district heating production., 14:31153 (R;SE;In Swedish)
Feasibility Studies
Buffalo district heating and cooling system: technical and economic assessment. Final report, 14:31150 (R;US)
Life-Cycle Cost
Comparative evaluation of hot water and steam distribution systems for district heating. Summary, 14:31139 (R;CA)
Comparative evaluation of hot water and steam distribution systems for district heating. Final report, 14:31138 (R;CA)
Optimization
Optimization of the total efficiency of district heating production., 14:31153 (R;SE;In Swedish)
Pipes
Adhesion between polyurethane insulation and media tubes, 14:31144 (R;DK;In Danish)
Dynamic characteristics of PUR cellular plastic in pre-insulated district heating pipes, 14:31146 (R;DK;In Danish)
Steam Systems
Rochester district-heating-system reconfiguration: technical and economic feasibility. Final report, 14:31151 (R;US)
Temperature Control
Low temperature heating in existing buildings, 14:31143 (R;DK;In Danish)
Waste Heat Utilization
Open cycle heat pump development for local resource use Phase II district heating case study analysis: Progress report, 1 January 1989–30 March 1989, 14:31137 (R;US)

Water Source Heat Pumps
Cold district heating from a quarry at Kaageroed. Evaluation of an experimental building project, 14:31135 (R;SE;In Swedish)

DISUSED MINESHAFTS
See ABANDONED SHAFTS

DNA
See also RECOMBINANT DNA
Biological Evolution
Transcripts of newt satellite DNA self-cleave in vitro, 14:32102 (BA;US)
Biological Radiation Effects
Induction and reparation of DNA strand breaks at neutron and X-ray irradiation at various stages of cell cycle, 14:32375 (RA;SU;In Russian)
Biological Repair
Induction and reparation of DNA strand breaks at neutron and X-ray irradiation at various stages of cell cycle, 14:32375 (RA;SU;In Russian)
Labelling
Identification of a non-specific inhibitor of [methyl^{3}H]thymidine incorporation into DNA of normal and pre-neoplastic cells, 14:32211 (R;US)
Metabolism
Investigation of the induction of oxidative DNA damage by means of an enzyme-linked immunosorbent assay (ELISA) for thymine glycol containing DNA, 14:32208 (R;DE;In German)
Modifications
"Normal" tissues from humans exposed to radium contain an alteration in the c-mos locus, 14:32371 (R;US)
Molecular Structure
Eukaryotic transposable elements as mutagenic agents, 14:32077 (R;US)
Nonlinear Problems
Statistical mechanics of a nonlinear model for DNA denaturation, 14:32207 (J;US)
Transcription
Possible mode of regulation of DNA transcription by steroid hormones: glucocorticoids, 14:32190 (BA;US)

DNA ADDUCTS
Biosynthesis
Fluorescence line narrowing spectrometric analysis of benzo[a]pyrene-DNA adducts formed by one-electron oxidation, 14:32402 (J;US)

DNA POLYMERASES
Biochemical Reaction Kinetics
Implications for enzymic catalysis from free-energy reaction coordinate profiles, 14:32142 (BA;US)

DNA REPAIR
Errors
Kinetic devices in protein synthesis, DNA replication, and mismatch repair, 14:32143 (BA;US)
Gene Regulation
Potential role of proteolysis in the control of UvrABC incision, 14:32201 (J;GB)

DNA SEQUENCING
Meetings
Cold Spring Harbor symposia on quantitative biology: Volume 51, Molecular biology of Homo sapiens, 14:32203 (B;US)

DODECANE
Phase Studies
Effect of uranium on third phase formation in the Pu(IV)-HNO_3-TBP-dodecane system, 14:30445 (J;US)

DOGS
Hazards
Free-ranging dogs and cats on the Oak Ridge Reservation: Situation and solution, 14:32409 (R;US)
Management
Free-ranging dogs and cats on the Oak Ridge Reservation: Situation and solution, 14:32409 (R;US)

DOLOMITE
Decomposition
Investigation on pyrolysis of Huangxian oil shale between 550° 750°C, 14:30344 (RA;CN)
Separation Processes
Advantage of uranium contained in low grade dolomite ore, 14:30427 (R;BR;In Portuguese)
Uranium
Advantage of uranium contained in low grade dolomite ore, 14:30427 (R;BR;In Portuguese)

DOMESTIC WASTES
See MUNICIPAL WASTES

DOMINICAN REPUBLIC
Charcoal
Fuel wood and charcoal research in the dominican republic. Results of the wood fuel development program, 14:30984 (R;DO)
Wood Fuels
Fuel wood and charcoal research in the dominican republic. Results of the wood fuel development program, 14:30984 (R;DO)

DOPAMINE
Isotachophoresis
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
Mass Spectroscopy
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)

DORMITORIES
See RESIDENTIAL BUILDINGS

DOSE EQUIVALENTS
Mathematical Models
Alternatives to dose, quality factor and dose equivalent for low level irradiation, 14:32367 (R;US)

DOSE RATEMETERS
Calibration
International intercomparison of environmental gamma dose-rate meters, 14:31829 (RA;AT)
Digital Systems
Fluctuations and accuracy of a digital exposure ratemeter, 14:31834 (RA;AT)
Energy Dependence
International intercomparison of environmental gamma dose-rate meters, 14:31829 (RA;AT)
Sensitivity
International intercomparison of environmental gamma dose-rate meters, 14:31829 (RA;AT)

DOSE RATES
Mathematical Models
Alternatives to dose, quality factor and dose equivalent for low level irradiation, 14:32367 (R;US)

DOSE REDUCTION FACTOR
See RADIOPROTECTIVE SUBSTANCES

DOSE RELATIVE FACTOR
See RADIOPROTECTIVE SUBSTANCES

DOSE-RESPONSE RELATIONSHIPS
Risk Assessment
Risk assessment and the linearity hypothesis, 14:32385 (RA;AT)

DOSEMETERS
See also BIOLOGICAL DOSEMETERS
Accuracy
Regulations in the Federal Republic of Germany to ensure a satisfactory quality of radiation protection dosemeters, 14:32776 (RA;AT)
Comparative Evaluations
Quo vadis, personnel monitoring?, 14:32772 (RA;AT)
Phosphate Glass
Phosphate glass dosimetry - after 25 years of routine use: new perspectives for personnel- and environment monitoring, 14:31838 (RA;AT;In German)

DOSIMETERS
See DOSEMETERS

DOSIMETRY
See also GAMMA DOSIMETRY
MICRODOSIMETRY
NEUTRON DOSIMETRY
PERSONNEL DOSIMETRY
THERMOLUMINESCENT DOSIMETRY
Measuring Instruments
Radiation protection instruments and methods - today and tommorrow, 14:31827 (RA;AT;In German)

Measuring Methods
Radiation protection instruments and methods - today and tomorrow, 14:31827 (RA;AT;In German)
Space Flight
Dosimetry of space radiation and radiation problems in manned space flight, 14:32760 (RA;IL)

DOUBLET 3 DEVICES
See DOUBLET REACTORS

DOUBLET REACTORS
Current-Drive Heating
60 MHz fast wave current drive experiments for DIII-D, 14:32871 (R;US)

DOUBLET-3 DEVICE
Plasma Heating
High power ion Bernstein wave experiments on DIII-D, 14:32870 (R;US)

DOW PUSHER 700
See POLYAMIDES

DOWEX
See ORGANIC ION EXCHANGERS

DPO
See ORGANIC PHOSPHORUS COMPOUNDS

DRF
See RADIOPROTECTIVE SUBSTANCES

DRIFT CHAMBERS
Performance Testing
Particle identification using dE/dx in the Mark II detector at the SLC, 14:31854 (R;US)

DRILL CORES
Comparative Evaluations
Lithologic composition and variability of the sediments underlying Kesterson Reservoir as interpreted from shallow cores, 14:32417 (R;US)
Compiled Data
NNWSI [Nevada Nuclear Waste Storage Investigations] 51 seismic hole histories, 14:30527 (R;US)
Cracks
Acoustic emissions during anelastic strain recovery of cores from deep boreholes, 14:32434 (R;US)

DRILL HOLES
See BOREHOLES

DRILL SHIPS
See OFFSHORE PLATFORMS

DRILLING FLUIDS
Filtration
New method for the cleaning of drilling mud, 14:31690 (R;NO;In Norwegian)

DRILLING MUD
See DRILLING FLUIDS

DRILLING PLATFORMS
See OFFSHORE PLATFORMS

DRILLING RIGS
Human Factors Engineering
Position controllable working platform in derricks, 14:31689 (R;NO;In Norwegian)

DRINKING WATER
Health Hazards
Borehole summary report for five ground-water monitoring wells constructed in the 1100 Area, 14:31967 (R;US)
Well installation and ground-water sampling plan for 1100 Area environmental monitoring wells, 14:31966 (R;US)
Pollutants
Analytical procedures for environmental quality control. Volume 2. Technical report, 14:32042 (R;US)

DROPLETS
Instability
Combustion enhancement by induced Rayleigh instability, 14:31681 (R;CA)
Nucleation
Simulations of cloud condensation droplet nucleation and growth, 14:31910 (R;US)
Size
Droplet size characteristics and energy input requirements of emulsions formed using high-intensity-pulsed electric fields, 14:31489 (J;US)

DRUGS
See also RADIOPROTECTIVE SUBSTANCES
Chemical Bonds
Thermodynamic calculations on biological molecules, 14:32191 (BA;US)
Supercritical Fluid Chromatography
Direct heated interface probe for capillary supercritical fluid chromatography/double focusing mass spectrometry, 14:31461 (J;US)

DRY DEPOSITION
See DEPOSITION

DTO
See DEUTERIUM COMPOUNDS
HEAVY WATER

DUAL-FUEL ENGINES
Compressed Gases
Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report, 14:31164 (R;US)
Performance
Evaluation of compressed natural gas conversion systems, 14:31166 (R;CA)

DUAL-PURPOSE POWER PLANTS
Combustion Products
Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988, 14:31988 (R;US)

DUSTS
Charged Particles
Micron-sized-particle impacts detected near Uranus by the Voyager 2 plasma-wave instrument. Progress report for period ending 1986, 14:32442 (R;US)
Indoor Air Pollution
Health-hazard evaluation determination report No. 74-9-174 Wheeling Steel Corporation, Steubenville, Ohio, 14:31961 (R;US)
Health-hazard evaluation determination report No. 75-121-281, Penn Central Transportation Company, Philadelphia, Pennsylvania, 14:31946 (R;US)
Health-hazard evaluation determination report No. 75-19-276, Masonite Corporation, Evendale, Ohio, 14:31959 (R;US)
Health-hazard evaluation determination report No. 75-87-280, Kawecki Berylco Industries, Inc., Reading, PA, 14:31943 (R;US)

DYES
See also PHTHALOCYANINES
RHODAMINES
Air Pollution
Industrial-hygiene survey, Bachmeier and Company, Kearny, New Jersey, November 4-8, 1985, 14:31952 (R;US)

DYMAC SYSTEM
See PLUTONIUM

DYNAMIC LOADS
Mechanical Tests
Dynamics and static behavior of metal gussets in cask impact limiters, 14:31613 (R;US)

DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See PLUTONIUM

DYNAMICS
Measuring Methods
Proposed technique for surface dynamics measurements at high pressure, 14:31492 (J;US)
Solitons
Determination of the onset of spatiotemporal complexity induced by soliton competition in a perturbed sine-Gordon chain, 14:32855 (J;US)

DYNAMICS (BEAM)
See BEAM DYNAMICS

DYSON REPRESENTATION
Schwinger Functional Equations
Schwinger-Dyson equations as supersymmetric Ward identities, 14:32619 (R;DK)
DYSPROSIUM
Magnetic Properties
Magnetic behavior in Mg-stabilized bcc β-Gd and β-Dy, 14:31254 (J;US)

E

E CODES
Fracture from an atomistic point of view, 14:31342 (BA;US)
Compiled Data
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)
Use of ETOG computer code for preparing the epithermal library of HAMMER with data from ENDF/B-IV, 14:32992 (R;BR;In Portuguese)
Epithermal Neutrons
Use of ETOG computer code for preparing the epithermal library of HAMMER with data from ENDF/B-IV, 14:32992 (R;BR;In Portuguese)
L Codes
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)
Modifications
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)
Multigroup Theory
Use of ETOG computer code for preparing the epithermal library of HAMMER with data from ENDF/B-IV, 14:32992 (R;BR;In Portuguese)
E-1422 RESONANCES
See F1-1420 MESONS
EARLY RADIATION INJURIES
See RADIATION INJURIES
EARTH ATMOSPHERE
See also IONOSPHERE
TROPOSPHERE
Aerosols
Analysis of aerosol samples from local atmosphere in Mexico City, 14:31906 (RA;BR)
Air Pollution Monitoring
Blue moons and large fires, 14:31980 (J;US)
Cosmic Radiation
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)
Magnetic Storms
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)
Meetings
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)
Mexico
Analysis of aerosol samples from local atmosphere in Mexico City, 14:31906 (RA;BR)
Pixe Analysis
Analysis of aerosol samples from local atmosphere in Mexico City, 14:31906 (RA;BR)
Technology Transfer
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)
EARTHQUAKES
Data Base Management
Data base pertinent to earthquake design basis, 14:30878 (R;IN)
Functional Models
Properties of earthquakes generated by fault dynamics, 14:32424 (J;US)
Risk Assessment
Data base pertinent to earthquake design basis, 14:30878 (R;IN)
Urban Areas
Geologic considerations for urban planning in seismic environment, 14:32420 (R;XA)
EBFA
See ELECTRON BEAM FUSION ACCELERATOR
ECOLOGICAL COMMUNITIES
See ECOSYSTEMS
ECOSYSTEMS
See also AQUATIC ECOSYSTEMS
TERRESTRIAL ECOSYSTEMS
Temperature Dependence
Influence of cooling water outlet of the Ringhals power plant on the coastal fish colony, 14:30886 (R;SE;In Swedish)
EDDY CURRENT TESTING
Implementation
Applications of large-eddy simulation: Model comparison and calibration: Technical report B048682-1, 14:31911 (R;US)
EDDY CURRENTS
Mathematical Models
Applications of large-eddy simulation: Model comparison and calibration: Technical report B048682-1, 14:31911 (R;US)
EDTA
Iron Compounds
Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)
Moessbauer Effect
Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)
EFFECTIVE ENERGY (INTERNAL IRRADIATION)
See INTERNAL IRRADIATION
EFFLUENTS (CHEMICAL)
See CHEMICAL EFFLUENTS
EFFLUENTS (GASEOUS)
See GASEOUS WASTES
EFFLUENTS (LIQUID)
See LIQUID WASTES
EFFLUENTS (RADIOACTIVE)
See RADIOACTIVE EFFLUENTS
EFFLUENTS (THERMAL)
See THERMAL EFFLUENTS
EFFUSION
See DIFFUSION
EGR SYSTEMS
See EXHAUST RECIRCULATION SYSTEMS
EINSTEIN COEFFICIENTS
Quenching
Quenching of Einstein's A-coefficients by photons, 14:32507 (R;US)
EINSTEIN FIELD EQUATIONS
A static cylindrically symmetric solution for perfect fluid in general relativity, 14:32850 (J;US)
EINSTEIN GRAVITATION THEORY
See GENERAL RELATIVITY THEORY
EINSTEIN-DE SITTER MODEL
See COSMOLOGICAL MODELS
ELASTIC PROPERTIES
See ELASTICITY
ELASTICITY
Monitoring
Sensors for in situ monitoring of elastic properties, 14:31622 (R;US)
ELASTOMERS
See also RUBBERS
Elasticity
Sensors for in situ monitoring of elastic properties, 14:31622 (R;US)
ELECTRIC BATTERIES
See also LEAD-ACID BATTERIES
Research Programs
ANL electrochemical program for DOE/EHP: Quarterly technical progress report for April through June 1988, 14:30961 (R;US)

Solid Electrolytes
Magnesium batteries. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:30962 (R;US)

ELECTRIC CABLES
See also SUPERCONDUCTING CABLES

Equipment Protection Devices
Development of improved sheath cross-bonding joint protectors for self-containing underground cables, 14:30814 (R;CA)

ELECTRIC CONDENSERS
See CAPACITORS

ELECTRIC CONDUCTORS

Magnetic Fields
Do steady fast magnetic dynamos exist?, 14:32540 (J;US)

ELECTRIC CONTACTORS
See SWITCHES

ELECTRIC GENERATORS
See also TURBOGENERATORS

Portable Equipment
Mobile electric power technologies for the Army of the future: engines, power source, and electrical aspects, 14:31005 (R;US)

ELECTRIC POWER
See also HYDROELECTRIC POWER

Cost
Least-cost planning: profiting from the negawatt revolution, 14:31009 (RA;US)

Energy Conservation
Load management - A way of reducing the costs for electric demand at Gustavsberg VVS AB, 14:31115 (R;SE;In Swedish)

Energy Quality
Integrated value-based planning, 14:31008 (RA;US)

Financial Assistance
Power shortages in developing countries: magnitude, impacts, solutions, and the role of the private sector: a report to Congress, 14:31033 (R;US)

Load Management
Load management - A way of reducing the costs for electric demand at Gustavsberg VVS AB, 14:31115 (R;SE;In Swedish)

ELECTRIC POWER INDUSTRY

Control Rooms
Human factors issues related to expert systems for electric power plant control rooms, 14:30791 (R;US)

Environmental Impacts
Annual site environmental report for calendar year 1988, 14:30805 (R;US)

ELECTRIC POWER RESEARCH INSTITUTE
See EPRI

ELECTRIC POWER SYSTEMS
See POWER SYSTEMS

ELECTRIC SWITCHES
See SWITCHES

ELECTRIC UTILITIES

Competition
Pricing - the marketing facilitator, 14:31026 (RA;US)

Computer Codes
WRATES, 14:31035 (J;US)

Cost Benefit Analysis
Information needs for value-based planning, 14:31017 (RA;US)

Cost Estimation
Cost escalators. Annual review, 14:31032 (R;CA)

Diversification
FPL Group - a case study of diversification, 14:31028 (RA;US)

Energy Storage
Energy storage on the supply side or the demand side, 14:30927 (R;CA)

Load Management
Analysis of water heater data from Athens load control experiment, 14:30819 (J;US)
Benefits and costs of small, short-lead-time power plants and demand-site programs in an era of load-growth uncertainty, 14:30797 (R;US)

Management
Demand-side management strategies for the 90s: Proceedings: Fourth national conference on utility DSM programs: Volume 1, 14:31007 (R;US)

Marketing
Customer segmentation, 14:31019 (RA;US)
Value of product differentiation in electricity markets, 14:31024 (RA;US)

Planning
Alternative scenarios for corporate planning, 14:30976 (R;CA)
Bulk power contracts: valuing reliability, 14:31030 (RA;US)
Corporate considerations related to competition: reshaping the corporation from the inside out, 14:31027 (RA;US)
Demand-side management audit: improving the estimates of DSM impacts, 14:31016 (RA;US)
End-use evaluation, 14:31021 (RA;US)
Forecasting and validating participation rates over time, 14:31015 (RA;US)
Importance of market segmentation in new service and rate offerings, 14:31023 (RA;US)
Information needs for value-based planning, 14:31017 (RA;US)
Integrated resource planning: a view from the trenches, 14:31011 (RA;US)
Integrated value-based planning, 14:31008 (RA;US)
Least-cost planning: profiting from the negawatt revolution, 14:31009 (RA;US)
Legacy of traditional planning, 14:31010 (RA;US)
Market assessment for future technologies, 14:31066 (RA;US)
Planning for electric utilities; the value of service, 14:31020 (RA;US)
Regulation of utility long-range planning, 14:31018 (RA;US)
Regulatory perspective on integrated value-based planning (IVP), 14:31013 (RA;US)
Strategic planning framework for technology evaluation, 14:31022 (RA;US)
Value of product differentiation in electricity markets, 14:31024 (RA;US)
What do we really mean by least-cost utility planning?, 14:31014 (RA;US)
Why utilities should promote DSM while choking on capacity surplus, 14:31012 (RA;US)

Power Demand
Forecasting and validating participation rates over time, 14:31015 (RA;US)

Rate Structure
Developing a pricing strategy: the case of nonutility generation, 14:31029 (RA;US)
Pricing - the marketing facilitator, 14:31026 (RA;US)

Reliability
Bulk power contracts: valuing reliability, 14:31030 (RA;US)

Resource Management
Integrated resource planning: who's going to do it?, 14:31025 (RA;US)

Technology Assessment
Strategic planning framework for technology evaluation, 14:31022 (RA;US)

ELECTRIC-POWERED VEHICLES

Design
New methods for the covering of the energy demand of agriculture. Mobile electric operation, 14:31131 (R;NO;In Norwegian)

Field Tests
Test program for electric vehicles and a follow-up of Swedish activities in this area, 14:31162 (R;SE;In Swedish)

Lead-Acid Batteries
Optimization of battery characteristics for urban electric van applications, 14:30964 (BA;US)
Recent developments in advanced lead-acid batteries for electric vehicle propulsion, 14:30965 (BA;US)

Optimization
Optimization of battery characteristics for urban electric van applications, 14:30964 (BA;US)

ELECTRICAL BREAKDOWN
See ELECTRICAL FAULTS

ELECTRICAL EQUIPMENT
See also ANTENNAS
CAPACITORS
ELECTRICAL INSULATORS
INVERTERS
SWITCHES
TRANSFORMERS
Expert Systems
Expert systems for analysis and management assistance of nuclear reactor electrical power supplies, 14:30863 (R;FR)
Fire Prevention
Development of design guidelines and practices for improving residential service entrances, 14:30816 (R;CA)
ELECTRICAL FAULTS
Measuring Instruments
Fault Location in the Finnish transmission network, 14:30813 (R;FI;In Finnish)
ELECTRICAL INSULATORS
Hall Effect
Low-field Hall effect near the percolation threshold, 14:31255 (J;US)
ELECTROCHEMICAL CELLS
See also ELECTRIC BATTERIES
FUEL CELLS
PHOTOELECTROCHEMICAL CELLS
Performance
Electrochemical oxidation of methane at metal and oxide electrodes. Annual report, December 1, 1987-December 1, 1988, 14:31046 (R;US)
ELECTROCHEMISTRY
Electrochemical oxidation of methane at metal and oxide electrodes. Annual report, December 1, 1987-December 1, 1988, 14:31046 (R;US)
ELECTRODES
See also ANODES
CATHODES
Corrosion
Electrode corrosion and ruthenium behavior in a small joule ceramic melter, 14:30519 (RA;US)
Design
Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)
Na- and S-activity measurements using glass-membrane reference electrodes/sensors, 14:31052 (BA;US)
Polishable and robust modified graphite epoxy electrodes, 14:31552 (J;US)
Electrochemistry
A 4-electrode analogue for estimating electrochemical reactions with bare metal surfaces at the crack tip, 14:31243 (J;US)
Steady-state and impedance analyses of electrochemical kinetics and mass transfer, 14:31551 (R;US)
Fabrication
Solid-state voltammetry in a three electrode electrochemical cell-on-a-chip with a microlithographically defined microelectrode, 14:31553 (J;US)
Materials Testing
Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)
ELECTRODYNAMICS
See also QUANTUM ELECTRODYNAMICS
Causality
Comment on "Resolution of causality violation in the classical radiation reaction", 14:32853 (J;US)
ELECTROKINETICS
See ELECTRODYNAMICS
ELECTROLYTES
See also SOLID ELECTROLYTES
Electrochemistry
Electrochemical characteristics of acid electrolytes for fuel cells. Final report, August 1, 1985-December 31, 1988, 14:31047 (R;US)
Failure Mode Analysis
Beta alumina failures in sodium/sulfur batteries, 14:30969 (BA;US)
Tubes
Characterization of processing flaws in beta alumina, 14:31291 (BA;US)
ELECTROMAGNETIC FIELDS
Biological Effects
Epidemiological studies relating human health to electric and magnetic fields. Criteria for evaluation, 14:32408 (R;CA)
Health Hazards
Occupational safety and health effects of high-voltage transmission lines, 14:32405 (R;US)
Lagrangian Field Theory
On canonical quantization of the electromagnetic field in terms of field strengths, 14:32633 (R;SU;In Russian)
Maxwell Equations
Neutron and gamma transport in air by TRIPOLI-2 time dependent energy deposition and electron current calculation, 14:32982 (R;FR)
Quantization
On canonical quantization of the electromagnetic field in terms of field strengths, 14:32633 (R;SU;In Russian)
T Codes
Neutron and gamma transport in air by TRIPOLI-2 time dependent energy deposition and electron current calculation, 14:32982 (R;FR)
Wave Propagation
New electromagnetic directed energy pulses, 14:32839 (R;US)
ELECTROMAGNETIC INTERACTIONS
See also PHOTON-PHOTON INTERACTIONS
Particle Production
Observation of excited charmed mesons, 14:32571 (J;US)
ELECTROMAGNETIC RADIATION
See also GAMMA RADIATION
INFRARED RADIATION
LASER RADIATION
RADIOWAVE RADIATION
X RADIATION
Biological Radiation Effects
Nonionizing electromagnetic radiation: biological effects. January 1972-April 1989 (Citations from the International Aerospace Abstracts data base). Report for January 1972-April 1989, 14:32407 (R;US)
Health Hazards
Questions and answers about biological effects and potential hazards of radiofrequency radiation (third edition), 14:32406 (R;US)
ELECTROMAGNETIC WAVES
See ELECTROMAGNETIC RADIATION
ELECTRON ACCEPTOR
See ELECTRONS
ELECTRON BEAM FUSION ACCELERATOR
Performance
Performance of the Hermes-III gamma ray simulator, 14:32930 (R;US)
ELECTRON BEAMS
Beam Dynamics
Assessment of a novel r-f linac amplifier concept. Final report, June 1987-July 1988, 14:31711 (R;US)
Dynamics of an electron in an rf gap, 14:31725 (R;US)
Beam Emittance
Experiments on investigation of angular characteristics of power microsecond REB, 14:32874 (R;SU;In Russian)
Beam Monitoring
Experiments on investigation of angular characteristics of power microsecond REB, 14:32874 (R;SU;In Russian)
Beam Transport
100-kJ microsecond REB transport in a one-meter solenoid, 14:32921 (R;SU;In Russian)
Beam-Beam Interactions
Observation of beam-beam deflections at the interaction point of the SLAC Linear Collider, 14:31730 (J;US)
Nuclear Industry
Review of the utilization of laser and electron beam methods in the nuclear domain, 14:32784 (R;FR;In French)

Quality Assurance
Uses of very high-power free-electron lasers based on electrostatic accelerators, 14:31648 (BA;US)
Technology Assessment
An investigation into the state-of-the-art of dielectric heating applications for lamination, 14:31121 (R;CA)
Wiggler Magnets
Installation of a ferrite undulator in the MAX storage ring, 14:31789 (R;SE)
ELECTRON CONFIGURATION (ATOMS)
See ELECTRONIC STRUCTURE
ELECTRON CYCLOTRON MASERS
See MICROWAVE AMPLIFIERS
ELECTRON DENSITY
Electron-density depletions in the nightside auroral zone. Progress report, 14:32477 (R;US)
ELECTRON DONOR
See ELECTRONS
ELECTRON GAS
Hall Effect
Role of localization within the vortex picture of the fractional quantum Hall effect, 14:32828 (R;DK)
ELECTRON GUNS
Mathematical Models
Simple models for electric gun operating characteristics, 14:31782 (R;US)
ELECTRON MOBILITY
Laser-Produced Plasma
Study of computational method about equations for laser fusion with superthermal electron transport and its applications, 14:32897 (R;CN;In Chinese)
ELECTRON PAIRS
Mev Range 01-10
Calculation of electron-pair creation cross sections on Sn and U, 14:32495 (RA;BR)
Pair Production
Calculation of electron-pair creation cross sections on Sn and U, 14:32495 (RA;BR)
ELECTRON PRECIPITATION
Energy Spectra
SPECTRUM - a computer algorithm to derive the flux-energy spectrum of precipitating particles from EISCAT electron density profiles, 14:32478 (R;SE)
ELECTRON REACTIONS
Elastic Scattering
Relativistic multipole operators for semileptonic weak and electromagnetic nuclear reactions, 14:32602 (J;US)
Knock-Out Reactions
Electrodisintegration of ^{6}Li studied with the reaction ^{6}Li($e,e'p$), 14:32660 (J;US)
ELECTRON TEMPERATURE
Hot Plasma
Plasma's electron temperature measurements in the TBR-1 Tokamak, 14:32872 (RA;BR)
Tbr Tokamak
Plasma's electron temperature measurements in the TBR-1 Tokamak, 14:32872 (RA;BR)
ELECTRON TRANSFER
Mathematical Models
Adiabaticity criteria for outer-sphere bimolecular electron-transfer reactions, 14:31510 (J;US)
Long distance electron transfer, 14:32178 (BA;US)
ELECTRON-ION COLLISIONS
Atomic physics using large electrostatic accelerators, 14:32490 (R;US)
ELECTRON-MOLECULE COLLISIONS
Cross Sections
Inclusion of electron correlation for the target wave function in low- to intermediate-energy e-N_2 scattering, 14:32482 (R;US)
ELECTRON-POSITRON COLLISIONS
Annihilation
Study of the e/sup +/e/sup -/ annihilation reaction into four leptons, 14:32634 (R;FR;In French)
Electron Reactions
Study of the e/sup +/e/sup -/ annihilation reaction into four leptons, 14:32634 (R;FR;In French)
ELECTRON-POSITRON INTERACTIONS
Annihilation
Λ_c^+ production and semileptonic decay in 29-GeV e^+e^- annihilation, 14:32574 (J;US)
Experimental evidence for the non-Abelian nature of QCD from a study of multijet events produced in e^+e^- annihilation, 14:32570 (J;US)
Observation of CHI/sub b/ and CHI/sub b/' production in exclusive decays of the Υ' and Υ'' with the CUSB detector at the Cornell e/sup +/e/sup -/ storage ring, 14:32547 (R;DE)
Search for the anomalous production of single photons in e^+e^- annihilation at $\sqrt{s}$ =29 GeV, 14:32577 (J;US)
Particle Production
Λ_c^+ production and semileptonic decay in 29-GeV e^+e^- annihilation, 14:32574 (J;US)
ELECTRON-PROTON INTERACTIONS
Annihilation
Effects of initial-state QCD interactions in the Drell-Yan process, 14:32644 (J;US)
ELECTRONIC CIRCUITS
See also SWITCHING CIRCUITS
TIMING CIRCUITS
Failed Element Detection
Resistive Contrast Imaging applied to multilevel interconnection failure analysis, 14:31675 (R;US)
ELECTRONIC DATA PROCESSING
See DATA PROCESSING
ELECTRONIC STRUCTURE
See also M SHELL
Calculation Methods
Comparison of optimization methods for electronic-structure calculations, 14:32813 (J;US)
ELECTRONS
See also SOLVATED ELECTRONS
Aurorae
Auroral electron accelerator. Manifestation of a universal ion/wave/electron interaction, 14:32479 (R;GB)
Distribution
Auroral electron accelerator. Manifestation of a universal ion/wave/electron interaction, 14:32479 (R;GB)
Energy Losses
Electron degradation and yields of initial products: V. Degradation spectra, the ionization yield, and the Fano factor for argon under electron irradiation, 14:32755 (J;US)
Energy Spectra
High energy electron and proton observations in the South Atlantic geomagnetic anomaly, 14:32474 (RA;BR)
Intensity maps of MeV electrons and protons below the radiation belt, 14:32475 (RA;BR)
Magnetic Storms
High energy electron and proton observations in the South Atlantic geomagnetic anomaly, 14:32474 (RA;BR)
Observation of high energy electrons and protons in the South Atlantic geomagnetic anomaly by Ohzora Satellite, 14:32473 (RA;BR)
Maps
Intensity maps of MeV electrons and protons below the radiation belt, 14:32475 (RA;BR)
Radiation Belts
Intensity maps of MeV electrons and protons below the radiation belt, 14:32475 (RA;BR)
Radiation Doses
Radiation dose in a Molniya-type orbit. Technical report, 14:32746 (R;US)
Southern Hemisphere
High energy electron and proton observations in the South Atlantic geomagnetic anomaly, 14:32474 (RA;BR)
Observation of high energy electrons and protons in the South Atlantic geomagnetic anomaly by Ohzora Satellite, 14:32473 (RA;BR)

ELECTROSTATIC ACCELERATORS
See also PELLETRON ACCELERATORS
Electric Charges
Development of charging belt for electrostatic accelerators, 14:31738 (R;SU;In Russian)
Electron Beams
Negative differential resistance of electron diode in magnetic field, 14:31717 (R;SU;In Russian)
Geometry
Uses of very high-power free-electron lasers based on electrostatic accelerators, 14:31648 (BA;US)
ELECTROSTATIC PRECIPITATORS
Efficiency
Magnetohydrodynamics Coal-Fired Flow Facility: Quarterly technical progress report, October–December 1988, 14:31041 (R;US)
ELECTROSTATIC WAVES
See PLASMA WAVES
ELUTION (SOLUBLE CONSTITUENTS)
See LEACHING
EMBRYOS
Lungs
Biophysical test methods for radioprotectors, 14:32379 (RA;AT)
EMERGENCIES
See ACCIDENTS
EMISSION
Regional Analysis
The role of regional activity forecasts in projecting emission trends of acid deposition precursors, 14:31918 (R;US)
EMISSION SPECTRA
Bibliographies
International bulletin on atomic and molecular data for fusion. No. 38, 14:32873 (R;XA)
EMPLOYEES
See PERSONNEL
EMULSIONS
Energy Transfer
Droplet size characteristics and energy input requirements of emulsions formed using high-intensity-pulsed electric fields, 14:31489 (J;US)
Stability
Review of the factors affecting the stability of solids-stabilized emulsions, 14:31494 (J;US)
ENCAPSULATION
Intermediate-Level Radioactive Wastes
Photofission assay of 500 litre drums of cemented intermediate level waste. Experimental measurements, 14:31382 (R;GB)
Quality Control
Photofission assay of 500 litre drums of cemented intermediate level waste. Experimental measurements, 14:31382 (R;GB)
ENDANGERED SPECIES
Manuals
Endangered Species Listing Handbook: handbook to preparing and processing actions to list, delist, or reclassify endangered or threatened species (third edition), 14:32076 (R;US)
ENDONUCLEASES
Enzyme Induction
Site-specific single strand endonuclease activity induced by NYs-1 virus infection of a Chlorella-like green alga, 14:32200 (J;GB)
ENDORPHINS
Molecular Structure
Energy-conformational studies of β-endorphins: identification of plausible folded conformers, 14:32181 (BA;US)
ENERGY ANALYSIS
See also ENERGY QUALITY
Research Programs
Energy Analysis Program: Annual report, FY 1988, 14:30971 (R;US)
ENERGY CONSERVATION
Energetic approach towards affordable transportation, 14:31104 (R;US)
Industrial Plants
Proceedings of the France - Korea 2. Joint Seminar on energy conservation vol. 1 et 2, 14:31106 (R;FR)
Meetings
Proceedings of the France - Korea 2. Joint Seminar on energy conservation vol. 1 et 2, 14:31106 (R;FR)
Municipal Wastes
Bio-adsorption (Pilot-scale). Investigation of cleansing effect and sludge formation, 14:31145 (R;DK;In Danish)
ENERGY CONSUMPTION
Computer Codes
ENCORE-CANADA. Computer program for the study of energy consumption of residential buildings in Canada, 14:31070 (R;CA)
Monitoring
Lessons learned from monitoring electricity use in multifamily residences: End-Use Load and Consumer Assessment Program (ELCAP), 14:31036 (R;US)
ENERGY CONVERSION
See also GEOTHERMAL ENERGY CONVERSION
SOLAR ENERGY CONVERSION
Organic Semiconductors
Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)
Solar Energy
Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)
ENERGY DEMAND
Program Management
Regulatory perspective on integrated value-based planning (IVP), 14:31013 (RA;US)
ENERGY EFFICIENCY
Least-cost planning: profiting from the negawatt revolution, 14:31009 (RA;US)
Program Management
Report of the Office of Energy. Project evaluation and implementation, 14:30993 (R;US)
ENERGY LEVELS
See also EXCITED STATES
Carbon 12 Reactions
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)
Carbon 14 Reactions
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)
Even-Even Nuclei
Study of spectroscopical properties of intermediate and heavy nuclei, 14:32715 (R;RO;In Romanian)
Even-Odd Nuclei
Study of spectroscopical properties of intermediate and heavy nuclei, 14:32715 (R;RO;In Romanian)
Nitrogen 15 Reactions
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)
Oxygen 16 Reactions
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)
ENERGY MANAGEMENT
Financing
Energy-management financing for state facilities and public schools, 14:30994 (R;US)
ENERGY OPERATORS
See HAMILTONIANS
ENERGY POLICY
Statement on energy policy 1988. Statement by the Ministry of Energy on laws concerning energy policy measures and Danish Oil and Natural Gas A/S, 14:31000 (R;DK;In Danish)
ENERGY QUALITY
Integrated value-based planning, 14:31008 (RA;US)
ENERGY SECURITY ACT
Synthetic Fuels Refineries
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report, third quarter, 1988. Report for 1 July-30 September 1988, 14:30424 (R;US)
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. First quarter 1988. Report for 1 January-31 March 1988, 14:30422 (R;US)

UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. Second quarter 1988. Report for 1 April-30 June 1988, 14:30423 (R;US)
UNOCAL Parachute Creek Shale Oil Project. Monitoring review committee meeting report. Annual meeting, 1987-1988, 14:30425 (R;US)

ENERGY SOURCE DEVELOPMENT
Budgets
Supplementary information for legislative review, 1988-89 estimates, 14:30998 (R;CA)

ENERGY SOURCES
See also FOSSIL FUELS
NUCLEAR FUELS

Brazil
National Energy Balance - 1982, 14:32969 (R;BR;In Portuguese)

Energy Accounting
National Energy Balance - 1980, 14:31037 (R;BR;In Portuguese)
National Energy Balance - 1982, 14:32969 (R;BR;In Portuguese)

ENERGY STORAGE
See also HEAT STORAGE
MAGNETIC ENERGY STORAGE
OFF-PEAK ENERGY STORAGE
Energy storage on the supply side or the demand side, 14:30927 (R;CA)

Solar Energy
Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)

Superconducting Magnets
Superconducting magnetic energy storage (SMES). January 1972-April 1989 (Citations from the NTIS database). Report for January 1972-April 1989, 14:31602 (R;US)

ENERGY STORAGE SYSTEMS
Research Programs
Demand-side load leveling battery storage at the Princeton Plasma Physics Laboratory, 14:30928 (BA;US)

ENERGY SUPPLIES
Forecasting
Short-term energy outlook: Quarterly projections, April 1989, 14:30995 (R;US)

ENERGY-LEVEL SCHEMES
See ENERGY LEVELS

ENGINEERING DRAWINGS
Specifications
The CALS Test Network MIL-D-28000 Class II reference drawing packet: Revision C, 14:33011 (R;US)

ENGLAND
See UNITED KINGDOM

ENHANCED RECOVERY
Transient liquid crystals in a W/O microemulsion, 14:30290 (R;US)

Research Programs
Contracts for field projects and supporting research on enhanced oil recovery: Progress review No. 55, quarter ending June 30, 1988, 14:30288 (R;US)

Waste Processing
Design operating manual for heavy oil miniplant, 14:30416 (R;CA)

ENRICHMENT (ISOTOPIC)
See ISOTOPE SEPARATION

ENVIRONMENT
Contamination
Medical radionuclides in the Austrian environment, 14:32011 (RA;AT)

Radiation Monitoring
Central registration system for on line monitoring of radioactivity concentrations and radiation levels, 14:31833 (RA;AT)
Developments in environmental monitoring, 14:30882 (RA;AT)
Experience with a continuously operating water sampling system, 14:31831 (RA;AT)
Sensitivity measurements of an environmental GM-monitor for Ra-226 series placed on the ground surface, 14:31830 (RA;AT)

Radioisotopes
Medical radionuclides in the Austrian environment, 14:32011 (RA;AT)

ENVIRONMENTAL IMPACTS
Operation
Environmental program planning for the proposed high-level nuclear waste repository at Yucca Mountain, Nevada: Volume 1, 14:30528 (R;US)

ENVIRONMENTAL QUALITY
See also AIR QUALITY
WATER QUALITY

Program Management
Strategy for developing environmental sampling and analysis programs at coal-gasification pilot and demonstration plants. Topical report, 14:30266 (R;US)

ENVIRONMENTAL TRANSPORT
See also RADIONUCLIDE MIGRATION
RUNOFF

Isotope Ratio
Determination of radioactive emission origins based on analyses of isotopic composition, 14:31987 (R;SE;In Swedish)

ENZYMATIC HYDROLYSIS
Mathematical Models
Effect of thermo-chemical pretreatment on the enzymatic hydrolysis of lignocellulosic substrates I, 14:30731 (RA;US)
Organosolv pretreatment, 14:30666 (RA;US)

Research Programs
Enzymology research, 14:30714 (RA;US)

ENZYME INHIBITORS
Biological Evolution
Biosynthesis, processing, and evolution of bovine pancreatic trypsin inhibitor, 14:32128 (BA;US)
Positive Darwinian selection in evolution of protein inhibitors of serine proteinases, 14:32132 (BA;US)
Serpins: evolution and adaptation in a family of protease inhibitors, 14:32130 (BA;US)

Molecular Structure
Phosphorus-containing peptide analogs as peptidase inhibitors, 14:32087 (BA;US)

Uptake
Identification of a non-specific inhibitor of [methyl^{3}H]thymidine incorporation into DNA of normal and pre-neoplastic cells, 14:32211 (R;US)

ENZYMES
See also ISOMERASES
LIGASES
OXIDOREDUCTASES

Biochemical Reaction Kinetics
Artificial enzymes, 14:32086 (BA;US)
Kinetic devices in protein synthesis, DNA replication, and mismatch repair, 14:32143 (BA;US)
Transmission of regulatory conformational changes through proteins, 14:32141 (BA;US)

Biological Evolution
Development of enzyme catalytic efficiency: an experimental approach, 14:32138 (BA;US)
Evolution of catalytic function, 14:32078 (BA;US)

Biological Functions
Economics of enzyme catalysis, 14:32085 (BA;US)

Chemical Properties
Natural selection, protein engineering, and the last riboorganism: rational model building in biochemistry, 14:32084 (BA;US)

Molecular Structure
Exon and domain evolution in the proenzymes of blood coagulation and fibrinolysis, 14:32171 (BA;US)

EPITHERMAL NEUTRONS
Compiled Data
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)

L Codes
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)

EPRI
Research Programs
EPRI 1986 LLW program, 14:30550 (RA;US)

EPSILON RESONANCES
See MESONS
EQUATIONS
See also REACTOR KINETICS EQUATIONS
Iterative Methods
Incomplete iterations in multistep backward difference methods for parabolic problems with smooth and nonsmooth data, 14:33016 (J;US)
EQUIPMENT INTERFACES
Design
Direct heated interface probe for capillary supercritical fluid chromatography/double focusing mass spectrometry, 14:31461 (J;US)
EQUIPMENT PROTECTION DEVICES
Long ion chamber systems for the SLC [Stanford Linear Collider], 14:31779 (R;US)
Testing
Lightning: Understanding it and protecting systems from its effects, 14:31677 (R;US)
ERBIUM OXIDES
Superconductivity
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
ESCHERICHIA COLI
Dna Sequencing
Application of neural networks and other machine learning algorithms to DNA sequence analysis, 14:32174 (R;US)
Gene Regulation
Cloning of the xylulokinase gene for improved yeast xylose fermentation. I.Cloning the yeast xylulokinase gene by complementation of E. coli xylulokinase mutation, 14:30733 (RA;US)
Growth
Overproduction of xylose isomerase and control of xy1A copy number in large-scale fermentations of Escherichia coli, 14:30732 (RA;US)
Immobilized Cells
Simultaneous fermentation and isomerization of xylose to ethanol, 14:30669 (RA;US)
Strand Breaks
Potential role of proteolysis in the control of UvrABC incision, 14:32201 (J;GB)
ESOPHAGUS
Carcinomas
MRT and CT of the esophageal cancer, 14:32252 (RA;DD;In German)
ESTERS
See also LACTONES
NITROUS ACID ESTERS
Structural Chemical Analysis
Experimental and theoretical study of the structures and optical rotations of chiral bicyclic ortho esters, 14:31497 (J;US)
ESTUARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
ETA MESONS
Physical Properties
Does the η meson bind to other hadrons?, 14:32598 (J;US)
ETA-1440 MESONS
E/ι in hadroproduction, 14:32552 (J;US)
ETA-549
See ETA MESONS
ETA-700 RESONANCES
See MESONS
ETCHING
Laser Radiation
Plasma initiated laser etching and deposition of semiconductor materials, 14:31343 (BA;US)
Selective photochemical dry etching of III-V compound semiconductors, 14:31344 (BA;US)
ETHANE
Hydroxylation
Biomimetic catalysis: Hydroxylation of C_2, C_3, and cycloC_6 hydrocarbons by managanese porphyrin and non-porphyrin catalysts in the presence of monooxygen transfer reagents, 14:30706 (R;US)
Thermodynamic Properties
Vapor-liquid equilibria in fluids of two-center Lennard-Jones molecules, 14:31546 (J;US)
1,2-ETHANEDIOL
See GLYCOLS
ETHANOL
Combustion Products
Atmospheric chemistry of aldehydes: enhanced peroxyacetyl nitrate formation from ethanol-fueled vehicular emissions, 14:31978 (J;US)
Production
Identification and evaluation of SERI-NF1 fungus for ethanol production from xylose fermentation, 14:30654 (R;US)
Yields
Acid recovery of polyamine, 14:30661 (RA;US)
Comparison of Saccharomyces cerevisiae and Candida shehatae for bioconversion of corn stover hydrolyzate to ethanol, 14:30670 (RA;US)
Dilute acid hydrolysis of high solids woods slurries in a two-stage continuous flow process, 14:30657 (RA;US)
Economic evaluation of pretreatment and non-pretreatment vendor size tests and costs for commercialization of the continuous enzymatic SSF for production of ethanol from cellulose waste, 14:30665 (RA;US)
Ethanol from cellulosic residues and crops, 14:30660 (RA;US)
Ethanol from lignocellulose: the DOE/SERI Biochemical Conversion/Alcohol Fuels Program, 14:30655 (RA;US)
Fermentability tests of sugars produced in the Solar Energy Research Institute's plug-flow reactor, 14:30658 (RA;US)
Fusarium strain development and selection for enhancement of ethanol production, 14:30671 (RA;US)
Integrated process for production of ethanol, 14:30664 (RA;US)
Overview of acid hydrolysis of lignocellulosics to liquid fuels, 14:30656 (RA;US)
Overview of enzymatic hydrolysis research, 14:30663 (RA;US)
Packed bed hydrodynamics of an acid hydrolysis percolation reactor, 14:30659 (RA;US)
Simultaneous fermentation and isomerization of xylose to ethanol, 14:30669 (RA;US)
Simultaneous saccharification and fermentation of cellulose and wheat straw to ethanol: evaluation of thermotolerant yeast and B-glucosidase supplementation, 14:30667 (RA;US)
Xylose fermentation analysis, 14:30668 (RA;US)
ETHERS
Indoor Air Pollution
Industrial-hygiene survey report, Cain Chemical, Inc., Bayport Plant, Pasadena, Texas, June 1-2, 1988, 14:31953 (R;US)
Toxicity
Rational selection of graph-theoretical indices in the QSAR, 14:32194 (BA;US)
ETHOCEL
See CELLULOSE
ETHERS
ETHYL ALCOHOL
See ETHANOL
ETHYL RADICALS
Ionization Potential
The ethyl radical: Photoionization and theoretical studies, 14:31479 (J;US)
Photoionization
The ethyl radical: Photoionization and theoretical studies, 14:31479 (J;US)
ETHYLENE GLYCOL
See GLYCOLS
ETHYLENE POLYMERS
See POLYETHYLENES
ETHYLENEDIAMINETETRAACETIC ACID
See EDTA
EUROPIUM
Solvent Extraction
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)

EUROPIUM OXIDES
Superconductivity
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
EVAPORATORS
Heat Transfer
Horizontal-tube falling-film evaporation with structured surfaces, 14:31660 (J;US)
Operation
Radwaste evaporator operating experience at Callaway Nuclear Plant, 14:30551 (RA;US)
EVOLUTION
See BIOLOGICAL EVOLUTION
EXCHANGE (HEAT)
See HEAT TRANSFER
EXCIMER LASERS
B-state excimer production following rare-gas halide trimer absorption, 14:31646 (BA;US)
Fabrication
Spectroscopy of ionic alkali halide excimers excited by laser-produced plasmas, 14:31641 (BA;US)
Laser Materials
Time-resolved absorption spectroscopy of Kr/sub 2/F(4/sup 2/T), 14:31642 (BA;US)
Uses
Laser processing, 14:31345 (BA;US)
EXCITATION
Contributions to the study of nuclei from the region Gd-146 excitation modes and interactions, 14:32721 (R;RO;In Romanian)
EXCITATION FUNCTIONS
Neon 20
/sup 20/Ne(/sup 16/O, /sup 16/O)/sup 20/Ne excitation function at θ/sub CM/ = 90 deg. and parity - dependent interactions, 14:32695 (R;AU)
Oxygen 16
/sup 20/Ne(/sup 16/O, /sup 16/O)/sup 20/Ne excitation function at θ/sub CM/ = 90 deg. and parity - dependent interactions, 14:32695 (R;AU)
EXCITED STATES
See also ROTATIONAL STATES
Highly excited nuclei state and level densities, 14:32716 (R;RO;In Romanian)
EXCITONS
Gallium Arsenides
Excitons in GaAs-Ga/sub 1-x/Al/sub x/As quantum wells, 14:32793 (RA;BR)
Potentials
Excitons in GaAs-Ga/sub 1-x/Al/sub x/As quantum wells, 14:32793 (RA;BR)
Quantum Electronics
Excitons in GaAs-Ga/sub 1-x/Al/sub x/As quantum wells, 14:32793 (RA;BR)
EXHAUST GAS RECIRCULATION SYSTEMS
See EXHAUST RECIRCULATION SYSTEMS
EXHAUST GASES
Air Pollution Abatement
Evaluation of a resistively heated metal-monolith catalytic converter on a gasoline-fueled vehicle. Technical report, 14:31160 (R;US)
Hydrocarbons
Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)
Processing
A tritium compatible plasma exhaust system for a large tokamak, 14:32942 (J;US)
Waste Heat Utilization
Use of gas-turbine exhaust for the direct drying of food products. Final report, 14:31124 (R;US)
EXHAUST RECIRCULATION SYSTEMS
Design
A tritium compatible plasma exhaust system for a large tokamak, 14:32942 (J;US)
EXHAUST SYSTEMS
See also EXHAUST RECIRCULATION SYSTEMS
Particulates
Analysis and in-cylinder measurement of particulate radiant emissions and temperature in a direct-injection diesel engine, 14:31156 (R;US)
EXOTIC RESONANCES
Detection
The search for scalar mesons, 14:32553 (J;US)
Physical Properties
Exotic mesons, 14:32600 (J;US)
Summary of the hybrids and exotics sessions, 14:32568 (J;US)
Spectroscopy
Exotic mesons in ÑN annihilation, 14:32555 (J;US)
EXPERIMENTAL DATA
Comparative Evaluations
Computed and measured responses of a thick-walled hollow cylinder of salt subjected to both homogeneous and inhomogeneous loading, 14:30585 (R;US)
EXPERIMENTAL FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
EXPERT SYSTEMS
Expert-system approach to large space-systems control. Technical report, September 1987-October 1988, 14:31891 (R;US)
Human Factors
Human factors issues related to expert systems for electric power plant control rooms, 14:30791 (R;US)
R Codes
Expert training systems to enhance plant operations decision making: Final report, 14:30876 (R;US)
EXPLOSIONS
See also ATMOSPHERIC EXPLOSIONS
NUCLEAR EXPLOSIONS
Control
Preferred explosives for blasting in oil shale mines, 14:30335 (RA;CN)
Mathematical Models
Application of a mixture theory model to the dispersal of solid by a high-pressure gas, 14:31896 (R;US)
EXPLOSIVE FRACTURING
Fracture Mechanics
Significance of dilatancy to in situ bed preparation, 14:30359 (RA;CN)
Technology Assessment
Advances in fragmentation for in situ bed production, 14:30358 (RA;CN)
EXPLOSIVES
See also CHEMICAL EXPLOSIVES
Detonations
Standardized piezoelectric polymer (PVDF) gauge for detonator response measurement, 14:31892 (R;US)
Energy Recovery
Pilot-scale testing of a fuel oil-explosives cofiring process for recovering energy from waste explosives: Final report, 14:31901 (R;US)
EXPOSURE (RADIATION DOSES)
See RADIATION DOSES
EXPOSURE RATEMETERS
Digital Systems
Fluctuations and accuracy of a digital exposure ratemeter, 14:31834 (RA;AT)
EXTRACTION (SOLVENT)
See SOLVENT EXTRACTION
EXTRACTION COLUMNS
Mass Transfer
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)
Performance
Performance of spray, sieve tray, and packed contactors for high pressure extraction, 14:31453 (J;US)
EYES
Endocrine Diseases
MRT in endocrine orbitopathia, 14:32257 (RA;DD;In German)

Nmr Imaging
MRT in endocrine orbitopathia, 14:32257 (RA;DD;In German)

F

F MESONS
Detection
The search for scalar mesons, 14:32553 (J;US)
F-1540 RESONANCES
See MESONS
F-2030 RESONANCES
See F MESONS
F1-1285 MESONS
Physical Properties
Search for A J^{PC} exotic hybrid meson, 14:32566 (J;US)
F1-1420 MESONS
Two-photon formation of spin-one resonances and the nature of the $E(1420)$, 14:32562 (J;US)
$E\iota$ in hadroproduction, 14:32552 (J;US)
F2-1720 MESONS
On the identification of θ ($f_2(1720)$) as a tensor glueball, 14:32595 (J;US)
FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
FACILITIES (MAINTENANCE)
See MAINTENANCE FACILITIES
FACILITIES (MILITARY)
See MILITARY FACILITIES
FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES
FACILITIES (RESOURCE RECOVERY)
See RESOURCE RECOVERY FACILITIES
FACILITIES (STORAGE)
See STORAGE FACILITIES
FALLOUT
See also FALLOUT DEPOSITS
Aerial Surveying
A review of aerial radiological surveys of Nevada Test Site fallout fields 1951 through 1970, 14:31984 (R;US)
Geographical Variations
Radiation burden of soil and vegetation in South Tyrol, Italy, after the Chernobyl accident, 14:32020 (RA;AT;In German)
Isotope Ratio
Estimation of the nuclide inventory of the Chernobyl core at the time of accident, 14:30846 (RA;AT)
FALLOUT DEPOSITS
Particle Resuspension
Resuspension of radionuclides during cultivation. Results from a single sample analysis, Spring 1987, 14:32007 (R;SE;In Swedish)
FALLOUT PARTICULATES
See FALLOUT
PARTICLES
FARADAY CAGES
See FARADAY CUPS
FARADAY CUPS
Beam dumps, stoppers and Faraday cups at the SLC, 14:31781 (R;US)
FAST FISSION
Energy Dependence
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
FAST FLUX TEST FACILITY REACTOR
See FFTF REACTOR
FAST NEUTRONS
Energy Spectra
Measurement of fast neutron spectra from iron shielded americium-beryllium source, 14:32751 (RA;AT)
Neutron Spectra
Dose rate and spectral parameters investigation of fast neutron beams in medico-biological complex of Kiev U-120 cyclotron, 14:32763 (RA;SU;In Russian)
Radiation Doses
Dose rate and spectral parameters investigation of fast neutron beams in medico-biological complex of Kiev U-120 cyclotron, 14:32763 (RA;SU;In Russian)
FASTBUS SYSTEM
Array Processors
A simple microprocessor for FASTBUS slave modules, 14:33014 (J;US)
FATTY ACIDS
See CARBOXYLIC ACIDS
FEATHERS
Heat Exchangers
Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus, 14:30851 (R;BR;In Portuguese)
Laminar Flow
Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus, 14:30851 (R;BR;In Portuguese)
Lmfbr Type Reactors
Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus, 14:30851 (R;BR;In Portuguese)
FEDERAL ASSISTANCE PROGRAMS
Program Management
Evaluation of DOE's Partnership in Low-Income Residential Retrofit (PILIRR) Program, 14:31075 (R;US)
FEDERAL DRIVING CYCLE
See FEDERAL TEST PROCEDURE
FEDERAL REGION VIII
See also COLORADO
NORTH DAKOTA
UTAH
Natural Gas Deposits
US Geological Survey publications on western tight gas reservoirs, 14:30314 (R;US)
FEDERAL REPUBLIC OF GERMANY
Nuclear Power Plants
Decommissioning of the Niederaichbach Nuclear Power Station (KKN) - remote dismantling, 14:30897 (RA;US)
Research Programs
Current situation with respect to oil shale research and the use of oil shale in the Federal Republic of Germany, 14:30325 (RA;CN)
FEDERAL TEST PROCEDURE
Evaluation of a resistively heated metal-monolith catalytic converter on a gasoline-fueled vehicle. Technical report, 14:31160 (R;US)
FEMUR
Necrosis
NMR imaging of aseptic necroses of the head of the femur, 14:32311 (RA;DD;In German)
Nmr Imaging
NMR imaging of aseptic necroses of the head of the femur, 14:32311 (RA;DD;In German)
FERMENTATION
Hemicellulose
Use of hemicellulose hydrolate in the production of fatty acids, 14:32175 (R;DK;In Danish)
FERMENTATION ALCOHOL
See ETHANOL
FERMILAB TEVATRON
Beam Dynamics
Orbital dynamics in the Tevatron double helix, 14:31714 (R;US)
Betatron Oscillations
Coherent betatron instability driven by electrostatic separators: Stability analysis of the Tevatron, 14:31713 (R;US)
Collisions
Fundamentally new physics at the Tevatron Collider?, 14:32592 (R;GB)
Particle Production
Fundamentally new physics at the Tevatron Collider?, 14:32592 (R;GB)
FERMIONS
See also BARYONS
LEPTONS
QUARKS

Dirac Operators
Preconditioning the Kogut-Susskind fermion matrix, 14:32642 (J;US)
Mass
Higgs coupling and the decoupling theorem, 14:32640 (J;US)
Random Phase Approximation
Random phase approximation studies in the fermion dynamical symmetry model: SO(8), 14:32743 (J;US)
FERRIC COMPOUNDS
See IRON COMPOUNDS
FERROCENE
Photochemical Reactions
Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces, 14:31524 (J;US)
Structural Chemical Analysis
High-pressure spectroscopic studies of ferrocene, nickelocene, and ruthenocene, 14:31503 (J;US)
Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene, 14:31504 (J;US)
FERROMAGNETIC MATERIALS
Calculation Methods
Vortices in the classical two-dimensional anisotropic Heisenberg model, 14:32811 (J;US)
Heisenberg Model
Vortices in the classical two-dimensional anisotropic Heisenberg model, 14:32811 (J;US)
FERROUS COMPOUNDS
See IRON COMPOUNDS
FFTF REACTOR
Loss Of Flow
Fast Flux Test Facility Passive Safety flow transient test, 14:30926 (R;US)
FIBER OPTICS
Pressure Measurement
Fiber optic sensing in a high explosives environment, 14:31874 (R;US)
FIBERGLASS
Turbine Blades
Project K 30 meter glass fiber wind turbine-blade. Technological description, 14:30786 (R;DK;In Danish)
FIBRINOLYSIS
Biological Evolution
Exon and domain evolution in the proenzymes of blood coagulation and fibrinolysis, 14:32171 (BA;US)
FIELD TESTS
Comparative Evaluations
High resolution subsurface imaging with geophysical diffraction tomography, 14:32419 (R;US)
FIELD-REVERSED MIRROR REACTORS
Plasma Heating
Design and performance of the 10-kV, 5-MA pulsed-power system for the FRX-C compression experiment, 14:32923 (R;US)
FIELDS (ELECTROMAGNETIC)
See ELECTROMAGNETIC FIELDS
FIELDS (MAGNETIC)
See MAGNETIC FIELDS
FINANCIAL MANAGMENT
See PROGRAM MANAGEMENT
FINGERPRINTING (OIL SPILLS)
See OIL SPILLS
FIRE STATIONS
See PUBLIC BUILDINGS
FIREDAMP
See METHANE
FIRES
Heat Flux
Thermal measurements in large pool fires, 14:31683 (J;US)
FISCHER ASSAY
Modifications
Factors affecting the results of Fischer assay of oil shale, 14:30381 (RA;CN)
FISCHER-TROPSCH SYNTHESIS
Catalysts
Alberta Research Council [research reports], 14:30372 (R;CA)
Characterisation of novel matrix catalysts and catalyst selectivity control for alpha olefin synthesis on the basis of CO and H/sub 2/, 14:30264 (R;DE;In German)
Chemical Reaction Kinetics
Effect of carbon dioxide on the kinetics of the Fischer-Tropsch synthesis on iron catalysts, 14:30267 (J;US)
FISHES
Behavior
Behavioural systems to guide or divert fish at hydro-electric facilities, 14:30699 (R;CA)
Columbia River
Method to directly measure maximum volume of fish stomachs or digestive tracts, 14:30696 (RA;US)
Population Density
Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part III. Abundance and distribution of northern squawfish, walleye, and smallmouth bass, 14:30686 (RA;US)
Population Dynamics
Population dynamics of northern squawfish and potential predation on juvenile salmonids in a Columbia River reservoir, 14:30688 (RA;US)
Population dynamics of walleye and smallmouth bass and potential on salmonid smolts in John Day Reservoir, 14:30689 (RA;US)
Prototype water reuse system, 14:30691 (RA;US)
Size selectivity and bias in estimates of population parameters of smallmouth bass, walleye, and northern squawfish in a Columbia River reservoir, 14:30695 (RA;US)
Predator-Prey Interactions
Digestive tract evacuation in northern squawfish (Ptychocheilus oregonensis), 14:30682 (RA;US)
Functional response of northern squawfish predation to salmonid prey density in McNary Tailrace, Columbia River, 14:30685 (RA;US)
Gastric evacuation in smallmouth bass (Micropterus dolomieui), 14:30683 (RA;US)
Predation by northern squawfish, walleye, smallmouth bass, and channel catfish in a mainstem Columbia River reservoir. I. Feeding ecology during the salmonid smolt out-migration, 14:30680 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part IV. Estimated total loss and mortality of juvenile salmonids to northern squawfish, walleye, and smallmouth bass, 14:30687 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia River Reservoir: Part II. Consumption rates of northern squawfish, walleye, smallmouth bass, and channel catfish, 14:30681 (RA;US)
Simulation of predation by a resident fish on juvenile salmonids in a Columbia River Reservoir, 14:30690 (RA;US)
Use of diagnostic bones to identify and estimate original lengths of ingested prey fishes, 14:30692 (RA;US)
Radioactivity
Radiological analysis of the upper Danube river system -a 20 years research programme, 14:32072 (RA;AT;In German)
Sampling
Variation in capture efficiency of a beach seine for small fishes, 14:30693 (RA;US)
Spatial Distribution
Effects of variation in flow on distributions of northern squawfish in the Columbia River below McNary Dam, 14:30694 (RA;US)
FISSILE MATERIALS
Radiation Monitoring
A combined thermal/epithermal neutron interrogation device to assay fissle materials in large containers, 14:31598 (R;US)
FISSION
See also FAST FISSION
Competing mechanisms in helium ions induced fission. The role of shell effects, 14:32717 (R;RO;In Romanian)
Our 50-year odyssey with fission: Summary, 14:32738 (R;US)

Diffusion
Particle evaporation-fission competition in nuclear fission considered as a diffusion process, 14:32697 (R;FR;In French)
Evaporation Model
Particle evaporation-fission competition in nuclear fission considered as a diffusion process, 14:32697 (R;FR;In French)
Neutron Reactions
Fission theory: Its relevance to the nuclear cross section data base, 14:32696 (R;US)
Prompt Neutrons
Evaluation of the energy dependence of the average number of prompt neutrons 4u-bar p for neutron-induced fission of /sup 235/U in the 0-20 MeV energy range, 14:32685 (RA;XA)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
Statistical Models
Recent developments in heavy-ion induced fission, 14:32694 (R;AU)

FISSION BARRIER
Calculation Methods
Fission theory: Its relevance to the nuclear cross section data base, 14:32696 (R;US)

FISSION FRAGMENTS
Angular Distribution
Angular anisotropy of fragments of /sup 235/U fission induced by 0.014-7.15 MeV neutrons, 14:32684 (RA;XA)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
Kinetic Energy
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
Nuclear Fireball Model
The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission, 14:32670 (R;US)

FISSION NEUTRONS
See also PROMPT NEUTRONS
Neutron Spectra
Theory of neutron emission in fission, 14:32737 (R;US)

FISSION PRODUCT RELEASE
Research Programs
Irradiation data for bump tests 1-11: Risoe Fission Gas Project: Revision, 14:30871 (R;DK)
Puncturing results and plenum spectrometry on IFA 148 pins and bump tests 1-11: Risoe Fission Gas Project, 14:30872 (R;DK)

FISSION PRODUCTS
Adsorption
Restoring solvent for nuclear separation processes, 14:30444 (J;US)
After-Heat
French studies for improvement of the data for radioactive sources, 14:30856 (R;FR)
Nuclear Data Collections
French studies for improvement of the data for radioactive sources, 14:30856 (R;FR)
Quantitative Chemical Analysis
Simultaneous estimation of Pu and fission products by gamma spectrometry, 14:31383 (R;IN)
Source Terms
French studies for improvement of the data for radioactive sources, 14:30856 (R;FR)

FIXED BED
See PACKED BED

FLAMES
Computerized Simulation
Low NO/sub x//SO/sub x/ burner trials. CFB Gagetown, 14:31680 (R;CA)
Fluorescence Spectroscopy
Calibration of imaging laser-induced fluorescence measurements in highly absorbing flames: an analytical reconstruction method, 14:31581 (R;SE)
Plasma Diagnostics
Simple compact monochromatic imaging system for plasma diagnostics, 14:31888 (J;US)

FLASKS
See CASKS

FLAT PLATE COLLECTORS
Heat Losses
Influence of convection on the temperature distribution and heat losses of solar collectors, 14:30759 (R;SE;In Swedish)

FLAVOR MODEL
Configuration Mixing
Mass ratio m/sub c//m/sub b/ in semi-leptonic b-decays, 14:32593 (J;NL)

FLAWS
See DEFECTS

FLOODING FLUIDS
See DISPLACEMENT FLUIDS

FLOW (FLUID)
See FLUID FLOW

FLOW RATE
Mathematical Models
A mathematical model of fluid flow in the vicinity of a horizontal air-injection well, 14:32033 (R;US)

FLUE GAS
Ammonia
Measuring ammonia content in flue gas, 14:30807 (R;DK;In Danish)
Desulfurization
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 3, January 1, 1989–March 31, 1989, 14:30274 (R;US)
Pollution Control
Combined SO_2/NO_x control technologies, 14:30271 (R;US)

FLUENCE (NEUTRON)
See NEUTRON FLUENCE

FLUID FLOW
See also GAS FLOW
HYPERSONIC FLOW
IDEAL FLOW
INCOMPRESSIBLE FLOW
MULTIPHASE FLOW
POTENTIAL FLOW
TWO-PHASE FLOW
UNSTEADY FLOW
VISCOUS FLOW
Fracture Mechanics
Characterization of fracture networks for fluid flow analysis, 14:32433 (R;US)
Noise
Water hammer in piping. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:31656 (R;US)
Variations
Effects of variation in flow on distributions of northern squawfish in the Columbia River below McNary Dam, 14:30694 (RA;US)

FLUID MECHANICS
Small internal waves in two-fluid systems. Technical summary report, 14:31651 (R;US)
Computer Calculations
Domain decomposition algorithms and computational fluid dynamics, 14:32531 (J;US)

FLUID-STRUCTURE INTERACTIONS
Mechanical Vibrations
Vibration analysis of fluid-solid systems using a finite element displacement formulation: Final report, Part III, 14:31619 (RA;US)
Reactor Components
Some studies on fluid structure interaction problems, 14:31653 (R;IN)

FLUIDIC DEVICES
Feasibility and analysis of fluidic-type devices in gas flow measurements. Final report, March 1987-March 1988, 14:30320 (R;US)

FLUIDIZED BED
See FLUIDIZED BEDS

FLUIDIZED BED BOILERS
Design
Fluid-bed boiler burning particulate Maoming oil shale, 14:30401 (RA;CN)
Emission
Environmental measurements at the Korsta CFB-boiler, 14:30801 (R;SE;In Swedish)
Flue Gas
Environmental measurements at the Korsta CFB-boiler, 14:30801 (R;SE;In Swedish)
Gas Analysis
Gas composition of the freeboard gas in a fluidized bed boiler., 14:31584 (R;SE;In Swedish)
Technology Assessment
Initiation and development of fluidized-bed boilers for oil shale in China, 14:30408 (RA;CN)
FLUIDIZED BEDS
Performance
Effects of particle shape and size distribution on sorption and flow performance in electrically stabilized expanded beds, 14:31449 (J;US)
Fluidized bed electrowinning of chromium from very dilute solutions, 14:31450 (J;US)
FLUIDIZED-BED COMBUSTORS
Wear
Metal wastage in fluidized-bed combustors, 14:30281 (R;US)
FLUIDS
See also CRYOGENIC FLUIDS
DISPLACEMENT FLUIDS
DRILLING FLUIDS
GASES
GEOTHERMAL FLUIDS
HEAT TRANSFER FLUIDS
LIQUIDS
RESERVOIR FLUIDS
Dynamics
Grassmann-valued fluid dynamics, 14:32849 (J;US)
Free Energy
Extension of Landau-Ginzburg free-energy functionals to high-gradient domains, 14:32541 (J;US)
Magnetic Fields
Do steady fast magnetic dynamos exist?, 14:32540 (J;US)
Rayleigh-Taylor Instability
Onset of nonlinear saturation for Rayleigh-Taylor growth in the presence of a full spectrum of modes, 14:32894 (J;US)
FLUORANTHENE
See CONDENSED AROMATICS
FLUORESCENT LAMPS
Mirrors
Performance evaluation of 3M Silverflux retrofit reflectors, 14:31077 (R;CA;In English and French)
FLUORIDES
See also BARIUM FLUORIDES
CALCIUM FLUORIDES
KRYPTON FLUORIDES
MANGANESE FLUORIDES
NEPTUNIUM FLUORIDES
PLUTONIUM FLUORIDES
THORIUM FLUORIDES
URANIUM FLUORIDES
Electronic Structure
Infrared spectrum of $F^- \times H_2O$, 14:31534 (J;US)
FLUORINE
Chemical Reaction Kinetics
Energy distribution of the CN products of the H+HCN, H+ClCN, and F+HCN reactions, 14:31544 (J;US)
Oxygen fluoride chemical kinetics, 14:31547 (J;US)
Reply to Comment on: Accurate three-dimensional quantum scattering calculations for $F+H_2 \rightarrow HF+H$, 14:31550 (J;US)
Chemical Reactions
Oxygen fluoride chemical kinetics, 14:31547 (J;US)
Gettering
Fluorine gettering by activated charcoal in a radiation environment, 14:31448 (J;US)
Mass Spectroscopy
Molecular beam studies of silicon etching by F/sub 2/, 14:31347 (BA;US)
Molecular Beams
Molecular beam studies of silicon etching by F/sub 2/, 14:31347 (BA;US)
FLUORINE 19 REACTIONS
Investigation of the reaction mechanisms in /sup 19/F -medium-light nuclei systems, 14:32718 (R;RO;In Romanian)
FLUORINE COMPOUNDS
See also FLUORIDES
FLUORINE OXIDES
Photolysis
Oxygen fluoride chemical kinetics, 14:31547 (J;US)
Structural Chemical Analysis
Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene, 14:31504 (J;US)
FLUORINE FLUORIDES
See FLUORINE
FLUORINE IONS
Ion-Molecule Collisions
Electron-electron interactions in transfer and excitation in $F^{8+} \rightarrow H_2$ collisions, 14:32516 (J;US)
Resonant transfer and excitation in collisions of Li-like F^{6+} and Ca^{17+} with light targets, 14:32523 (J;US)
FLUORINE OXIDES
Thermodynamic Properties
Thermodynamic Properties of Dioxygen Difluoride (O_2F_2) and Dioxygen Fluoride (O_2F), 14:31486 (J;US)
FLUOROSCOPY
Indirect fluorometric detection in gel electrophysics, 14:31404 (J;US)
FLUORS
See PHOSPHORS
FLUX (METALLURGY)
See METALLURGICAL FLUX
FLUX (NEUTRON)
See NEUTRON FLUX
FLY ASH
Bibliographies
Fly ash in concrete. Compilation of abstracts of papers from recent international conferences and symposia on fly ash in concrete, 14:31111 (R;CA)
Carbon
TEOM(trade mark) real-time carbon-concentration monitor. Final report, 14:30809 (R;US)
Waste Disposal
Liner-waste compatibility studies for coal-fired power plants, 14:31112 (R;US)
Waste Product Utilization
Fly ash in concrete. Compilation of abstracts of papers from recent international conferences and symposia on fly ash in concrete, 14:31111 (R;CA)
FOG (SPRAYS)
See SPRAYS
FOLIAGE
See LEAVES
FOOD
See also ANIMAL FEEDS
MILK
Irradiation
Ionization technology, 14:30645 (R;FR;In French)
FOOD CHAINS
Contamination
/sup 131/I-activity in man's thyroid and /sup 137/Cs-activity in muscle tissue, 14:32014 (RA;AT;In German)
Cesium- and iodine contamination of food in South Tyrol, Italy, 14:32362 (RA;AT;In German)
Measurements of the Research Centre Seibersdorf with regard to the reactor accident at Chernobyl, 14:32015 (RA;AT)
Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)

Radioecological Concentration
Environmental radioactivity in Chile - during 1987 - Technical information, 14:32756 (R;CL;In Spanish)
Risk Assessment
Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)

FOOD INDUSTRY
Development and field test of a desiccant-based air conditioning system for supermarkets. Final report, October 1983-May 1988, 14:31073 (R;US)
Geothermal Process Heat
Industrial applications, 14:30782 (RA;US)

FOOD IRRADIATION
See FOOD PROCESSING
IRRADIATION

FOOD PROCESSING
Drying
Use of gas-turbine exhaust for the direct drying of food products. Final report, 14:31124 (R;US)

FOODSTUFFS
See FOOD

FORESTRY
Short Rotation Cultivation
Testing station at Soesdala. Experiments concerning energy forest on organogenic soil (exploited peatland), 14:30741 (R;SE;In Swedish)

FORESTS
Liming
Forest liming in small catchment areas. Background information and preliminary results on liming effects 1983-1987, 14:32004 (R;SE)
Plant Growth
The effect of nitrogen accumulation and nitrification on soil chemical properties in alder forests, 14:30701 (R;US)

FORMALDEHYDE
Molecular Structure
Ab initio molecular orbital study of hydrogen bonding and ion-molecule association in model systems for DNA bases, 14:32187 (BA;US)
Stark Effect
Stark effect on dynamics and spectroscopy of isolated molecules, 14:31517 (J;US)

FORMALIN
See FORMALDEHYDE

FORMALITH
See FORMALDEHYDE

FORMATES
Catalytic Effects
Mini-melter studies of high level nuclear waste form development: effects of added nitrates, carbonates and nitrates/formates in the slurry feed, 14:30506 (RA;US)

FORMIC ALDEHYDE
See FORMALDEHYDE

FORMING (MATERIALS)
See MATERIALS WORKING

FORMOL
See FORMALDEHYDE

FORSCHUNGSREAKTOR BERLIN-2
See BER-2 REACTOR

FORTRAN
Modifications
The challenge of change for Fortran, 14:33013 (R;US)

FOSSIL FUEL RESERVES
See FOSSIL FUELS

FOSSIL FUELS
See also COAL
NATURAL GAS
OIL SANDS
OIL SHALES
PEAT
PETROLEUM
SHALE OIL
Prices
Fuel cells for extraterrestrial and terrestrial applications, 14:31053 (J;US)

FOSSIL-FUEL POWER PLANTS
Air Pollution
Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985, 14:30799 (R;US)
Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988, 14:30800 (R;US)
Air Pollution Monitoring
N_2O field study. Final report, 14:30810 (R;US)
Coal Preparation
Technical/economic impacts and implications of using washed coals at New York State utilities. Final report, 14:30798 (R;US)
Environmental Impacts
Ecological effects of coal use. Final report, 14:30806 (R;DE;In German)
Fly Ash
TEOM(trade mark) real-time carbon-concentration monitor. Final report, 14:30809 (R;US)
Fuel Supplies
Utilization of Estonian oil shale at thermal power plants, 14:30409 (RA;CN)
Hazardous Materials
Hydrazine: usage and exposure in the electric power industry, 14:30808 (R;US)
Monitoring
Power plant performance monitoring and improvement: Volume 6, Economic dispatch optimization, 14:30794 (R;US)
Pipelines
Microbial corrosion: 1988 workshop proceedings, 14:30865 (R;US)

FRACER-FULCO METHOD
See DISPERSION RELATIONS

FRACTURE PROPERTIES
Evaluation
Dynamic fracture toughness measurements of ferritic ductile cast iron, 14:31604 (R;US)

FRACTURE STRENGTH
See FRACTURE PROPERTIES

FRACTURE TOUGHNESS
See FRACTURE PROPERTIES

FRACTURES
Computerized Simulation
Fracture from an atomistic point of view, 14:31342 (BA;US)

FRACTURES (BONE)
See BONE FRACTURES

FRAGMENTS (FALLOUT)
See FALLOUT

FRAGMENTS (FISSION)
See FISSION FRAGMENTS

FRAGMENTS (PARTICLES)
See PARTICLES

FRANCE
Radioactive Waste Facilities
Vitrification plants in France, 14:30497 (RA;US)
Seasonal Thermal Energy Storage
Heat storage and heat pumps on aquifer. Two case studies, 14:30931 (RA;CA;In English and French)
Project of thermal storage in deep aquifer (Sarcelles, France). Simulation of the hydraulic and thermal behaviour of the system, 14:30958 (RA;CA;In English and French)
Project of thermal storage in deep aquifer (Sarcelles, France). Technical data and economic analysis, 14:30940 (RA;CA;In English and French)
Prototype of underground high-temperature heat storage in Thiverval-Grignon (France), 14:30933 (RA;CA;In French)
Sensible Heat Storage
Underground heat storage in France. Present stage development and future prospects, 14:30948 (RA;CA;In English and French)

Waste Heat Utilization
Project of thermal storage in deep aquifer (Sarcelles, France). Technical data and economic analysis, 14:30940 (RA;CA;In English and French)
Underground heat storage in France. Present stage development and future prospects, 14:30948 (RA;CA;In English and French)

FRASCATI TOKAMAK
See FT TOKAMAK

FREE ELECTRON LASERS
Amplifiers
Assessment of a novel r-f linac amplifier concept. Final report, June 1987-July 1988, 14:31711 (R;US)
Beam Emittance
Requirements of high-surface electric fields for high-brightness Fel injectors, 14:31731 (R;FR)
Design
Elements of a realistic 17 GHz FEL/TBA design, 14:31697 (R;US)
Electron Beam Injection
Requirements of high-surface electric fields for high-brightness Fel injectors, 14:31731 (R;FR)
Electron Beams
Assessment of a novel r-f linac amplifier concept. Final report, June 1987-July 1988, 14:31711 (R;US)
Modifications
Recent experiments with the free-electron laser at Los Alamos, 14:31628 (R;US)
Performance
Uses of very high-power free-electron lasers based on electrostatic accelerators, 14:31648 (BA;US)
Superradiance
Free electron lasers. Status and perspectives, 14:32914 (RA;IT)

FRENKEL DEFECTS
Recombination
Recombination zone of Frenkel pairs in metals, 14:31212 (RA;SU;In Russian)

FRESH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

FRICTION
De-Excitation
Contribution to the determination of nuclear friction by studying the de-excitation of nuclei in the transient regime, 14:32698 (R;FR;In French)
Fission
Contribution to the determination of nuclear friction by studying the de-excitation of nuclei in the transient regime, 14:32698 (R;FR;In French)
Reduction
Friction-reducing additive scale-up experiments in a pilot-scale DHC system simulator, 14:31136 (R;US)

FRICTIONLESS FLOW
See IDEAL FLOW

FRM DEVICES (THERMONUCLEAR)
See FIELD-REVERSED MIRROR REACTORS

FROGS
Gene Regulation
Zinc fingers: a novel protein fold for nucleic acid recognition, 14:32124 (BA;US)

FT TOKAMAK
Lower Hybrid Heating
Lower hybrid heating in high density discharge in FT, 14:32868 (RA;IT)
Magnets
Construction and test results of the FTU toroidal magnet, 14:32911 (RA;IT)
Plasma Confinement
Engineering features, assembly equipment and installation procedures of the FTU machine, 14:32908 (RA;IT)
Rf Systems
Engineering features, assembly equipment and installation procedures of the FTU machine, 14:32908 (RA;IT)
New design for the coupling structures in FTU. Technological problems, 14:32912 (RA;IT)
Thermonuclear Reactor Cooling Systems
Contributions to the 12th. International Cryogenic Engineering Conference. Southampton, 12-15 July 1988, 14:32905 (R;IT)
Liquid nitrogen cooling system for FTU Tokamak machine, 14:32906 (RA;IT)
Vacuum Systems
New design for the coupling structures in FTU. Technological problems, 14:32912 (RA;IT)

FTR REACTOR (RICHLAND)
See FFTF REACTOR

FUEL ADDITIVES
Production
Preferential adsorption and selective permeation of alcohol/hydrocarbon mixtures in reverse osmosis, 14:31430 (J;US)

FUEL ASSEMBLIES
Fabrication
Manufacture of the first fuel charge for the SUPER-PHENIX 1 reactor, 14:30847 (R;FR)
Mixed Oxide Fuel Fabrication Plants
Manufacture of the first fuel charge for the SUPER-PHENIX 1 reactor, 14:30847 (R;FR)
Mixed Oxide Fuels
Manufacture of the first fuel charge for the SUPER-PHENIX 1 reactor, 14:30847 (R;FR)

FUEL CELLS
See also ACID ELECTROLYTE FUEL CELLS
HIGH-TEMPERATURE FUEL CELLS
HYDROGEN FUEL CELLS
NATURAL GAS FUEL CELLS
Research Programs
Participation of the Hydrogen Industry Council. At the round table of the Fuel Cell Workshop, 14:31045 (RA;CA)
Technology Assessment
Impressions of the Japanese Sunshine and Moonlight projects, 14:30989 (R;DK)
Participation of the Hydrogen Industry Council. At the round table of the Fuel Cell Workshop, 14:31045 (RA;CA)
Transportation Sector
Fuel cells for use in the field of transportation. American initiatives, 14:31044 (R;DK;In Danish)

FUEL CHANNELS
Heat Transfer
Transport coefficients for laminar and turbulent flow through a four-cusp channel, 14:31655 (R;BR)

FUEL COOLING INSTALLATIONS
See SPENT FUEL STORAGE

FUEL CYCLE
Australia
Prospects for Australian involvement in the nuclear fuel cycle, 14:30453 (R;AU)
Reviews
Nuclear power and the nuclear fuel cycle. A quarterly review of overseas events, 14:30991 (R;AU)

FUEL ELEMENTS
See also FUEL PINS
FUEL RODS
SPENT FUEL ELEMENTS
Irradiation
Modeling of the behaviour under irradiation of the nuclear fuel containing thorium, uranium and plutonium oxides, 14:30436 (R;RO;In Romanian)

FUEL PELLETS
Microstructure
The Studsvik Super-Ramp Extension Project: Ceramography of Asea Atom test fuel rod OL1-1, 14:30832 (R;SE)

FUEL PENCILS
See FUEL PINS

FUEL PINS
Fission Product Release
Irradiation data for bump tests 1-11: Risoe Fission Gas Project: Revision, 14:30871 (R;DK)
Puncturing results and plenum spectrometry on IFA 148 pins and bump tests 1-11: Risoe Fission Gas Project, 14:30872 (R;DK)

FUEL ROD CONSOLIDATION
See FUEL RODS

FUEL RODS
Ceramography
Ceramography of AA test fuel rods OA1-1, OA1-2 and OL1-4: The Super-Ramp Extension Project, 14:30873 (R;SE)
Destructive Testing
The Studsvik Super-Ramp Extension Project: Destructive post-irradiation examinations of rod group PK 1X, 14:30836 (R;SE)
Irradiation
Fabrication, pre-irradiation characterization and base-irradiation data of test fuel rod group PK1X: The Super-Ramp Extenstion Project, 14:30843 (R;SE)
The Studsvik Super-Ramp Extension Project: Ceramography of Asea Atom test fuel rod OL1-1, 14:30832 (R;SE)
The Studsvik Super-Ramp Extension Project: Non destructive examinations of the PK1X rod and the rod OL1-5, 14:30834 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1984–February 28, 1985, 14:30831 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1985–March 31, 1986, 14:30835 (R;SE)
Performance Testing
Power ramp irradiation of AA test fuel rods OA1-1,-2,-3,-4 and OL1-1, -4: The Super-Ramp Extension Project, 14:30830 (R;SE)

FUEL SLUGS
See FUEL RODS

FUEL SUBSTITUTION
Environmental Impacts
Proceedings of the fourth Windsor workshop on alternative fuels, 14:31154 (R;CA)
Meetings
Proceedings of the fourth Windsor workshop on alternative fuels, 14:31154 (R;CA)

FUEL-CLADDING INTERACTIONS
The Studsvik Super-Ramp Extension Project: Ceramography of Asea Atom test fuel rod OL1-1, 14:30832 (R;SE)
The Studsvik Super-Ramp Extension Project: Destructive post-irradiation examinations of rod group PK 1X, 14:30836 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1984–February 28, 1985, 14:30831 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1985–March 31, 1986, 14:30835 (R;SE)

FUELS
See also AUTOMOTIVE FUELS
FOSSIL FUELS
JET ENGINE FUELS
LIQUID FUELS
NUCLEAR FUELS
Combustion
Fuels combustion research. Final technical report, 1 October 1985-30 September 1988, 14:31579 (R;US)
Comparative Evaluations
Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988, 14:31098 (R;US)
Production
Biofuels program summary: Volume 1, Overview fiscal year 1988, 14:30702 (R;US)

FUELS (NUCLEAR)
See NUCLEAR FUELS

FUMES
See AEROSOLS

FURANS
Thermodynamic Properties
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)

FURNACES
See also GAS FURNACES
Design
Development of a multi-purpose incinerating melter, 14:30486 (RA;US)
Loading
Glass melter feed system for vitrification of radioactive waste, 14:30521 (RA;US)
Performance Testing
Electrode corrosion and ruthenium behavior in a small joule ceramic melter, 14:30519 (RA;US)
Physical modeling test of joule heated ceramic melter system for high level waste vitrification, 14:30517 (RA;US)
Pilot plant demonstration of the Defense Waste Processing Facility (DWPF) melter concepts, 14:30502 (RA;US)
Start-Up
Startup sequence of the DWPF scale glass melter, 14:30518 (RA;US)

FURNITURE INDUSTRY
Hazardous Materials
Health-hazard evaluation determination report No. 75-146-254, Custom Furniture and Cabinets, Inc., Post Falls, Idaho, 14:31964 (R;US)

FUSARIUM
Genetic Engineering
Fusarium strain development and selection for enhancement of ethanol production, 14:30671 (RA;US)

FUSHUN PROCESS
Retorts
Technical features of Fushun-type retort today, 14:30357 (RA;CN)

FUSION REACTIONS
See HEAVY ION FUSION REACTIONS

G

GADOLINIUM
Magnetic Properties
Magnetic behavior in Mg-stabilized bcc β-Gd and β-Dy, 14:31254 (J;US)
Spin Waves
Spin dynamics of Gd at high temperatures, 14:31253 (J;US)

GADOLINIUM 146
Energy Levels
$^{148}Gd(p,t)^{146}Gd$ reaction: Neutron states in ^{146}Gd, 14:32676 (J;US)

GADOLINIUM 148 TARGET
Proton Reactions
$^{148}Gd(p,t)^{146}Gd$ reaction: Neutron states in ^{146}Gd, 14:32676 (J;US)

GADOLINIUM 152
Excited States
Measurement of total neutron cross sections for /sup 152/Gd and /sup 153/Gd(T/sub 1/2/=242 days), 14:32675 (RA;SU;In Russian)

GADOLINIUM 152 TARGET
Neutron Reactions
Measurement of total neutron cross sections for /sup 152/Gd and /sup 153/Gd(T/sub 1/2/=242 days), 14:32675 (RA;SU;In Russian)

GADOLINIUM 153
Excited States
Measurement of total neutron cross sections for /sup 152/Gd and /sup 153/Gd(T/sub 1/2/=242 days), 14:32675 (RA;SU;In Russian)
Neutron Reactions
Measurement of total neutron cross sections for /sup 152/Gd and /sup 153/Gd(T/sub 1/2/=242 days), 14:32675 (RA;SU;In Russian)

GADOLINIUM OXIDES
Superconductivity
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)

GALACTIC EVOLUTION
Simulation
Spiral-vortex structure of flat galaxies (prediction, theory, laboratory and numerical experiments, observations), 14:32455 (RA;CS)

GALLBLADDER
See BILIARY TRACT
GALLIUM
Arsenic
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
Indium
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
Quaternary Alloy Systems
Contribution to the study of zinc and cadmium diffusions in InP and In/sub 0,97/ Ga/sub 0,03/ As/sub 0,08/ P/sub 0,92/ quaternary compound, 14:31199 (R;BR;In Portuguese)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
Superlattices
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
X-Ray Emission Analysis
Trace element determinations with synchrotron-induced x-ray emission, 14:31463 (J;US)
GALLIUM ALLOYS
Hole Mobility
Hall mobility of positive carriers in the semimetallic compound LiGa, 14:31264 (J;US)
GALLIUM ARSENIDE SOLAR CELLS
Efficiency
Research on tandem solar cells. Volume 1. Final report. Volume 2. Appendices. Report for 15 May 1984-1 August 1985, 14:30707 (R;US)
GALLIUM ARSENIDES
Aluminium
Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE), 14:32789 (RA;BR)
Crystal Growth
Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE), 14:32789 (RA;BR)
Crystal Structure
InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)
Electron-Phonon Coupling
Excitons in GaAs-Ga/sub 1-x/Al/sub x/As quantum wells, 14:32793 (RA;BR)
Electronic Structure
Electronic and structural properties of a discommensurate monolayer system: GaAs(110)-(1×1)Bi, 14:31377 (J;US)
Energy-Level Transitions
Saturation of intersubband transitions in *p*-type semiconductor quantum wells, 14:32812 (J;US)
Indium
InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)
Optical investigation of atomic steps in ultra-thin InGaAs/InP quantum wells grown by vapor levitation epitaxy, 14:31230 (R;BR)
Interstitials
Charge state stability of interstitial impurities in gallium arsenide, 14:32791 (RA;BR)
Lithium
Lithium compensation of GaAs, 14:31177 (R;AU)
Photochemical Reactions
Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces, 14:31524 (J;US)
Physical Radiation Effects
Carrier lifetimes in ion-damaged GaAs, 14:31357 (J;US)
Crystalline to amorphous transformation in GaAs during Kr ion bombardment: A study of elastic behavior, 14:31349 (J;US)
Reflectivity
Interference effects probed by photoreflectance spectroscopy, 14:31352 (J;US)
Sorptive Properties
Electronic and structural properties of a discommensurate monolayer system: GaAs(110)-(1×1)Bi, 14:31377 (J;US)
Substrates
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
Superlattices
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
Tin
Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE), 14:32789 (RA;BR)
GALLIUM PHOSPHIDES
Photoluminescence
Photoluminescence in (Ga,In)P at high pressure, 14:31364 (J;US)
GALLSTONES
See BILIARY TRACT CALCULI
GAMMA ASTRONOMY
Research Programs
The application of two-dimensional imaging to very high energy gamma ray astronomy: Progress report, 14:32444 (R;US)
GAMMA CAMERAS
Collimators
Comparison of various methods relating to radionuclide examination of the thyroid gland, 14:32345 (R;DE;In German)
GAMMA DECAY
Compiled Data
Gamma-ray emission probabilities of the daughters of ^{238}U, 14:32692 (R;US)
GAMMA DETECTION
An imaging detector for neutron or gamma sources, 14:31824 (R;US)
Balloons
Measurements of low energy gamma radiation balloon experiment for supernova 1987A, 14:31798 (RA;BR)
Supernovae
Measurements of low energy gamma radiation balloon experiment for supernova 1987A, 14:31798 (RA;BR)
GAMMA DOSIMETRY
Dosemeters
1987 Neutron and gamma personnel dosimeter intercomparison study using a D_2O-moderated ^{252}Cf source, 14:31848 (R;US)
GAMMA RADIATION
Backscattering
Back scattering coefficients for 50 to 400 kV X-rays scattered on baryt concrete, 14:32750 (RA;AT)
Cosmic Ray Sources
Coded mask telescope for observations of X and gamma ray sources in the Southern sky, 14:31797 (RA;BR)
Elastic Scattering
Elastic and inelastic scattering of 59.54 KeV gamma rays, 14:32500 (RA;BR)
Inelastic Scattering
Elastic and inelastic scattering of 59.54 KeV gamma rays, 14:32500 (RA;BR)
Inelastic scattering of gamma rays from K-shell electrons of tantalum, 14:32496 (RA;BR)
K Shell
Inelastic scattering of gamma rays from K-shell electrons of tantalum, 14:32496 (RA;BR)
Kev Range 10-100
Elastic and inelastic scattering of 59.54 KeV gamma rays, 14:32500 (RA;BR)
Pulsars
Ballon-Borne experiments to study hard x-rays and gamma-rays from SN 1987 A, 14:31795 (RA;BR)
Scintillation Counters
Ballon-Borne experiments to study hard x-rays and gamma-rays from SN 1987 A, 14:31795 (RA;BR)

Shielding
Gamma shielding by buildings, 14:31600 (RA;AT;In German)
Southern Hemisphere
Coded mask telescope for observations of X and gamma ray sources in the Southern sky, 14:31797 (RA;BR)
Tantalum
Inelastic scattering of gamma rays from K-shell electrons of tantalum, 14:32496 (RA;BR)

GAMMA REACTIONS
See PHOTONUCLEAR REACTIONS

GAMMA SPECTROMETERS
See also COMPTON SPECTROMETERS
Data Acquisition Systems
Low-background setup for the investigation of rare processes of nuclear decay, 14:31818 (R;SU;In Russian)
Design
Scientific considerations in the design of the Mars observer gamma-ray spectrometer, 14:32458 (R;US)
NaI Detectors
Low-background setup for the investigation of rare processes of nuclear decay, 14:31818 (R;SU;In Russian)
Pulse Generators
Precision impulse generator for stabilization of a semiconductor spectrometer, 14:31821 (R;SU;In Russian)
Stability
Precision impulse generator for stabilization of a semiconductor spectrometer, 14:31821 (R;SU;In Russian)

GAS COOLANTS
See GASES

GAS ENGINES
See INTERNAL COMBUSTION ENGINES

GAS FLOW
Aerosols
Aerosol particle deposition in numerically simulated channel flow, 14:32532 (J;US)
Finite Difference Method
Adaptive mesh refinement on moving quadrilateral grids, 14:32530 (R;US)
Fluidic Devices
Feasibility and analysis of fluidic-type devices in gas flow measurements. Final report, March 1987-March 1988, 14:30320 (R;US)

GAS FURNACES
Field Tests
Field evaluation of high-efficiency gas furnaces. Final report, 14:30323 (R;US)

GAS GENERATORS
Design
Large capacity aggregates for retorting lump oil shale, 14:30356 (RA;CN)
Fabrication
Construction of a simplified wood gas generator for fueling internal combustion engines in a petroleum emergency, 14:30674 (R;US)

GAS HEAT PUMPS
Design
Gas-engine heat-pump system and component efficiency and reliability improvement. Phase 2 report, September 1986-January 1989, 14:31074 (R;US)

GAS LASERS
See also CARBON DIOXIDE LASERS
EXCIMER LASERS
Efficiency
High-pressure Ar-Xe waveguide lasers with microwave discharge excitation, 14:31638 (BA;US)

GAS METERS
Fluidic Devices
Feasibility and analysis of fluidic-type devices in gas flow measurements. Final report, March 1987-March 1988, 14:30320 (R;US)

GAS PRODUCTION RATES
Corrosion
Investigations of hydrogen generation by iron corrosion under repository conditions, 14:31217 (R;CH;In German)

GAS TURBINE ENGINES
Ceramics
Ceramics technology: automotive gas-turbine-engine component applications. January 1976-April 1989 (Citations from the NTIS data base). Report for January 1976-April 1989, 14:31285 (R;US)

GAS TURBINES
See also COAL-FIRED GAS TURBINES
Exhaust Gases
Use of gas-turbine exhaust for the direct drying of food products. Final report, 14:31124 (R;US)
Performance Testing
Systems analyses for high-temperature fuel cells, 14:31049 (BA;US)

GAS UTILITIES
Marketing
Customer segmentation, 14:31019 (RA;US)
Planning
Corporate considerations related to competition: reshaping the corporation from the inside out, 14:31027 (RA;US)
Regulation of utility long-range planning, 14:31018 (RA;US)
Regulatory perspective on integrated value-based planning (IVP), 14:31013 (RA;US)
What do we really mean by least-cost utility planning?, 14:31014 (RA;US)

GAS WELLS
See NATURAL GAS WELLS

GASEOUS EFFLUENTS
See GASEOUS WASTES

GASEOUS WASTES
See also EXHAUST GASES
FLUE GAS
Fluidized-Bed Combustion
Modified-in-situ technology combined with aboveground retorting and circulating fluid bed combustors could offer a viable method to unlock oil shale reserves in the near future, 14:30360 (RA;CN)
Molecular Sieve Process
Transportation of tritiated waste from fusion facilities, 14:32940 (J;US)

GASES
See also AIR
COMPRESSED GASES
ELECTRON GAS
EXHAUST GASES
RARE GASES
Equations Of State
Real gas equations of state for CHEMKIN, 14:31335 (R;US)
Expansion
Application of a mixture theory model to the dispersal of solid by a high-pressure gas, 14:31896 (R;US)
Production
Gas generation from the irradiation of mortar, 14:30524 (R;US)
Synthesis
Study of gas evolution during oil shale pyrolysis by TQMS, 14:30346 (RA;CN)

GASIFICATION
See also COAL GASIFICATION
Catalysts
Thermally initiated carbon-carbon bond-cleavage reactions occurring during coal gasification. Final report, April 1985-June 1988, 14:30265 (R;US)

GASOLINE
Charges
State uses of Exxon and Stripper Well oil overcharge funds: Status report No. 3, 14:30306 (R;US)
Production
Upgrading Julia Creek shale oil - syncrude or fully refined products, 14:30363 (RA;CN)

GASOLINE ENGINES
See INTERNAL COMBUSTION ENGINES

GASTEROPODS
See MOLLUSCS

GEIGER-MUELLER COUNTERS
Sensitivity
Sensitivity measurements of an environmental GM-monitor for Ra-226 series placed on the ground surface, 14:31830 (RA;AT)
GELS
Diffusion
Study of cooperative processes in polymer gels by the method of slow neutron transmission, 14:32800 (R;SU;In Russian)
Friction
Study of cooperative processes in polymer gels by the method of slow neutron transmission, 14:32800 (R;SU;In Russian)
GENE LOCI
See GENES
GENERAL RELATIVITY THEORY
Gauge invariant gravitation theory. 1. Gravitational field source and spin, 14:32632 (R;SU;In Russian)
Energy-Momentum Tensor
Does static solution exist for a gravitating flat wall, 14:32825 (R;SU)
Gravitational Fields
Does static solution exist for a gravitating flat wall, 14:32825 (R;SU)
Space-Time
Traversable wormholes: Some simple examples, 14:32854 (J;US)
GENERATING CAPACITY
See CAPACITY
GENERATORS (ELECTRIC)
See ELECTRIC GENERATORS
GENERATORS (PULSE)
See PULSE GENERATORS
GENERATORS (STEAM)
See STEAM GENERATORS
GENES
Biological Evolution
What introns have to tell us: hierarchy in genome evolution, 14:32169 (BA;US)
Modifications
Eukaryotic transposable elements as mutagenic agents, 14:32077 (R;US)
Molecular Structure
Exon theory of genes, 14:32168 (BA;US)
Origin
Protein architecture and the origin of introns, 14:32170 (BA;US)
GENETIC MAPPING
Meetings
Cold Spring Harbor symposia on quantitative biology: Volume 51, Molecular biology of Homo sapiens, 14:32203 (B;US)
GEOCHEMICAL SURVEYS
Isotope Applications
Geochronology and geochemistry by nuclear tracks method: some utilization examples in geologic applied, 14:32412 (R;BR;In Portuguese)
Technology Assessment
Exploration for direct heat resources, 14:30762 (RA;US)
GEOCHEMISTRY
P Codes
Guide to PICKER - a data selection program for the geochemical code PHREEQE, 14:32071 (R;GB)
GEOCHRONOLOGY
See AGE ESTIMATION
GEOLOGIC STRUCTURES
See also SEDIMENTARY BASINS
Tomography
Site characterization and validation. Borehole radar investigations, Stage 1, 14:30609 (R;SE)
GEOLOGIC SURVEYS
Technology Assessment
Exploration for direct heat resources, 14:30762 (RA;US)
GEOLOGICAL SURVEYS
See GEOLOGIC SURVEYS
GEOPHYSICAL SURVEYS
Reviews
Determining geotechnical and hydrogeological parameters using downhole geophysics in the Canadian plains. Phase 1 report. A review of potential applications, vol. 1, 14:32422 (R;CA)
Technology Assessment
Exploration for direct heat resources, 14:30762 (RA;US)
GEORGIA
Military Facilities
Installation restoration program. Phase 2. Confirmation/quantification stage 2, Moody Air Force Base, Georgia. Appendices. Volume 2. Final report, October 1986-November 1987, 14:32031 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)
GEOTHERMAL AREAS
See GEOTHERMAL FIELDS
GEOTHERMAL DISTRICT HEATING
Demonstration Programs
Demonstration projects lessons learned, 14:30774 (RA;US)
GEOTHERMAL ENERGY CONVERSION
Life-Cycle Cost
Engineering cost analysis, 14:30783 (RA;US)
GEOTHERMAL EXPLORATION
Planning
Exploration for direct heat resources, 14:30762 (RA;US)
GEOTHERMAL FIELDS
Flow Models
Geothermal field case studies that document the usefulness of models in predicting reservoir and well behavior, 14:30772 (R;US)
GEOTHERMAL FLUIDS
Corrosive Effects
Materials selection guidelines, 14:30775 (RA;US)
Heat Recovery
Heat exchangers, 14:30776 (RA;US)
Sampling
Geothermal fluid sampling techniques, 14:30763 (RA;US)
Transport
Piping geothermal fluids, 14:30771 (RA;US)
Waste Processing
Developments in geothermal waste treatment biotechnology, 14:30766 (R;US)
GEOTHERMAL HEATING SYSTEMS
Corrosion Resistant Alloys
Materials selection guidelines, 14:30775 (RA;US)
GEOTHERMAL PROCESS HEAT
Demonstration Programs
Demonstration projects lessons learned, 14:30774 (RA;US)
GEOTHERMAL REFRIGERATION
Absorption Refrigeration Cycle
Absorption refrigeration, 14:30779 (RA;US)
GEOTHERMAL REGIONS
See GEOTHERMAL FIELDS
GEOTHERMAL RESOURCES
Reservoir Engineering
Well testing and reservoir evaluation, 14:30769 (RA;US)
Resource Development
Environmental considerations, 14:30767 (RA;US)
Regulatory and commercial aspects, 14:30765 (RA;US)
Resource Potential
Nature of geothermal resources, 14:30760 (RA;US)
Uses
Introduction, 14:30773 (RA;US)
GEOTHERMAL SPACE HEATING
Demonstration Programs
Demonstration projects lessons learned, 14:30774 (RA;US)
Heating Systems
Space heating equipment, 14:30777 (RA;US)

GEOTHERMAL WATER HEATING
Space heating equipment, 14:30777 (RA;US)
GEOTHERMAL WELLS
Corrosion Resistant Alloys
Materials selection guidelines, 14:30775 (RA;US)
Performance
Geothermal field case studies that document the usefulness of models in predicting reservoir and well behavior, 14:30772 (R;US)
Pumps
Well pumps, 14:30770 (RA;US)
Testing
Well testing and reservoir evaluation, 14:30769 (RA;US)
Well Completion
Drilling and well construction, 14:30768 (RA;US)
Well Drilling
Drilling and well construction, 14:30768 (RA;US)
GERMAN FEDERAL REPUBLIC
See FEDERAL REPUBLIC OF GERMANY
GERMANIUM
Fabrication
Fabrication of isotopic heterostructures and epitaxial thin films by ion beam deposition, 14:31346 (BA;US)
GERMANIUM 76 TARGET
Krypton 86 Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
GERMANIUM ALLOYS
Electronic Structure
Electronic structure of [110] Si-Ge thin-layer superlattices, 14:31358 (J;US)
GERMANY (FEDERAL REPUBLIC)
See FEDERAL REPUBLIC OF GERMANY
GERMS (MICROORGANISMS)
See MICROORGANISMS
GIANT RESONANCE
E1-Transitions
Giant dipole resonances in hot nuclear matter in the model of self-relaxing mean-field, 14:32707 (R;DE)
Temperature Dependence
Monopole and quadrupole vibrations of a hot nucleus, 14:32705 (R;DE)
GLASS
See also BOROSILICATE GLASS
Chemical Analysis
Characterization and comparison of highly radioactive and simulated glass and glass ceramic waste forms, 14:30511 (RA;US)
Chemical Composition
A statistical approach for characterizing chemical durability within a waste glass compositional region, 14:31348 (J;US)
Na- and S-activity measurements using glass-membrane reference electrodes/sensors, 14:31052 (BA;US)
Corrosion Resistance
Reliability of Li/SO/sub 2/ cells for long life applications, 14:30963 (BA;US)
Crack Propagation
Fracture mechanics of crack branching in ceramics, 14:31288 (BA;US)
Defects
Study of defect centres in irradiated optical fibre glasses by electron spin resonance spectroscopy, 14:31315 (R;GB)
Electrolytes
Na- and S-activity measurements using glass-membrane reference electrodes/sensors, 14:31052 (BA;US)
Fracture Mechanics
Fractographic determination of crack-tip stress intensity, 14:31290 (BA;US)
Fracturing
Model predictions of glass fracturing in canisters during decontamination, 14:30520 (RA;US)
Ionic Conductivity
Na- and S-activity measurements using glass-membrane reference electrodes/sensors, 14:31052 (BA;US)
Irradiation
Study of defect centres in irradiated optical fibre glasses by electron spin resonance spectroscopy, 14:31315 (R;GB)
Leaching
Leach testing of simulated Hanford Waste Vitrification Plant reference glass HW-39, 14:30573 (R;US)
Long term leach behavior of West Valley HLW glasses, 14:30510 (RA;US)
Membranes
Na- and S-activity measurements using glass-membrane reference electrodes/sensors, 14:31052 (BA;US)
Performance Testing
Effects of composition on the leach behavior of West Valley HLW glasses, 14:30522 (RA;US)
Removal
Design and testing of the Defense Waste Processing Facility melter drain valve, 14:30507 (RA;US)
GLASS SCINTILLATORS
Neutron Detectors
Detector system for two-dimensional, position-sensitive detection of neutrons and gamma quanta, 14:31816 (R;DE;In German)
GLASSY METALS
See METALLIC GLASSES
GLAUBER'S SALT
See SODIUM SULFATES
GLIOMAS
Radiotherapy
Cerebral tumours in adults. A review of results achieved with radiotherapy, 14:32346 (R;DE;In German)
GLOBIN
See also HEMOGLOBIN
MYOGLOBIN
Amino Acid Sequence
Globins: a case study in molecular phylogeny, 14:32166 (BA;US)
GLOVEBOXES
Cleaning
Technical aspects of the upgrade and commissioning of the tritium and related systems at TFTR, 14:32944 (J;US)
Design
A new glove-box system for a high-pressure tritium pump, 14:31624 (J;US)
GLUCOCORTICOIDS
Biochemical Reaction Kinetics
Possible mode of regulation of DNA transcription by steroid hormones: glucocorticoids, 14:32190 (BA;US)
GLUCOSE
Anaerobic Digestion
Modeling of Brettanomyces clausenii growth on mixtures of glucose and cellobiose, 14:30712 (RA;US)
Biochemical Reaction Kinetics
Following macromolecular interactions and sugar metabolism using site specific ^{3}H labelling and NMR spectroscopy, 14:32210 (R;US)
Fermentation
Experimental studies of the progressing batch reactor, 14:30710 (RA;US)
Fermentability tests of sugars produced in the Solar Energy Research Institute's plug-flow reactor, 14:30658 (RA;US)
GLUCOSIDASE
Cross-Linking
Beta-glucosidase crosslinking for stability and enzyme recycle, 14:30717 (RA;US)
Enzyme Activity
Denaturation behavior of fungal and thermostable-bacterial beta-glucosidases, 14:30716 (RA;US)
Improvements of enzymatic hydrolysis of cellulose: strain development of Trichoderma reesei, 14:30726 (RA;US)
Thermostable cellulase enzymes from Acidothermus cellulolyticus: studies with growth media activities, 14:30721 (RA;US)
Fractionation
Synthesis of an affinity gel for purification of beta-glucosidases, 14:30718 (RA;US)

GLUEBALLS
Physical Properties
Future opportunities for hadron spectroscopy at the MPS, 14:32567 (J;US)
GLUONIUM
See GLUEBALLS
GLUONS
Green Function
Linear response of hot gluons, 14:32596 (J;US)
GLYCERIN
See GLYCEROL
GLYCEROL
Mass Spectroscopy
Evaluation of pulsed fast-atom bombardment ionization for increased sensitivity of tandem mass spectrometry, 14:31401 (J;US)
GLYCOLS
See also POLYETHYLENE GLYCOLS
Ethers
Industrial-hygiene survey report, Cain Chemical, Inc., Bayport Plant, Pasadena, Texas, June 1-2, 1988, 14:31953 (R;US)
Solubility
Improvement of CO_2 flood performance: Quarterly report, October–December 1988, 14:30291 (R;US)
Solvent Properties
Crown ethers as solvent extraction reagents: where do we stand?, 14:31413 (J;US)
GLYCOSYL HYDROLASES
Enzyme Activity
Thermostable cellulase enzymes from Acidothermus cellulolyticus: studies with growth media activities, 14:30721 (RA;US)
GOBAR GAS
See METHANE
GOETHITE
Sorptive Properties
Kinetic studies of cadmium and ferricyanide adsorption on goethite, 14:32048 (J;US)
GOLD
Fluorescence
Atomic fluorescence yields W/sub M4/, W/sub M5/, W/sub N4/ and W/sub N5/ of the elements Ir,Pt,Au,Th and U, 14:32497 (RA;BR)
Photochemical Reactions
Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces, 14:31524 (J;US)
Scattering
Evidence against the existence of strong diffuse x-ray scattering from gold twist boundaries at room temperature, 14:32786 (R;US)
Sorptive Properties
Near-infrared surface-enhanced Raman spectroscopy. Part I: Copper and gold electrodes, 14:31356 (J;US)
GOLD 197 TARGET
Heavy Ion Reactions
Fission in intermediate energy heavy ion reactions, 14:32681 (R;US)
Neutron Reactions
Measurement of the neutron radiative capture cross-sections for /sup 236/U and /sup 197/Au in the 3-420 keV energy range, 14:32687 (RA;XA)
Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
Oxygen 16 Reactions
Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)
GOLD ALLOYS
Solution Heat
Alloy models with the embedded-atom method, 14:31257 (J;US)
GOLD COMPLEXES
Silicon
Microscopic models for (Au-Au) and (Pt-Pt) pair complexes in silicon, 14:32790 (RA;BR)
GOLD COMPOUNDS
Diagnostic Techniques
Antibody-gold cluster conjugates, 14:32177 (P;US)
GONADS
Radiation Doses
Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)
GOVERNMENT POLICIES
See also ENERGY POLICY
Evaluation
Illustrative emission reduction scenarios, 14:31922 (R;US)
GRAIN ALCOHOL
See ETHANOL
GRAIN BOUNDARIES
Computerized Simulation
Grain-boundary modeling, 14:31235 (BA;US)
High-temperature behavior of grain boundaries from embedded atom method molecular dynamics simulation, 14:31188 (R;US)
Embrittlement
Experimental studies of the structure of grain boundaries: Progress report, 14:31191 (R;US)
Raman Spectra
Study of nanophase TiO_2 grain boundaries by Raman spectroscopy, 14:31271 (R;US)
GRAINS (CEREAL)
See CEREALS
GRAND UNIFIED THEORY
Particle Multiplets
Random dynamics and relations between the number of fermion generations and the fine structure, 14:32591 (R;DK)
GRANITES
Diffusion
Long-term solute diffusion in a granite block immersed in sea water, 14:30561 (R;FR)
Hydraulic Conductivity
Scale effect experiment in a fractured rock mass phase 2. Volume 1. Description of hydraulic tests carried out on the experimental site at Fanay-Augeres, 14:30555 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 2. Interpretation and modelling of the hydraulic tests carried out on the experimental site at Fanay-Augeres, 14:30556 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 3. Description of the tracer tests carried out on the experimental site at Fanay-Augeres, 14:30557 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 5. Methodology and results of in-situ stress measurement carried out in the granitic rock mass at Fanay-Augeres, 14:30559 (R;FR;In French)
Scale effects experiment in a fractured rock mass phase 2. Volume 4. Interpretation and modelling of the tracer tests carried out on the experimental site at Fanay-Augeres, 14:30558 (R;FR;In French)
Physical Properties
Seismic coupling of nuclear explosions: Volume 1, 14:31904 (R;US)
GRANULAR MATERIALS
Waste Product Utilization
Multipurpose use of shale ash and its paragenetic mineral in China, 14:30404 (RA;CN)
GRAPHITE
Bragg Reflection
X-ray determination of the modulation potential in a stage-2 potassium-graphite intercalation compound, 14:31363 (J;US)
Nondestructive Testing
Measured damping and modulus of composite cylinders, 14:31662 (R;US)
Physical Properties
Thin-film deposition by a new laser ablation and plasma hybrid technique, 14:31359 (J;US)

Sorptive Properties
Carbonaceous solids as a model for adsorption by dispersion forces, 14:31516 (J;US)
Relative and kinetic properties of carbon monoxide and carbon dioxide on a graphite surface, 14:31523 (J;US)
Rotational states of H_2, HD, and D_2 on graphite, 14:31369 (J;US)
Surface Coating
Thin-film deposition by a new laser ablation and plasma hybrid technique, 14:31359 (J;US)
Temperature Effects
Thermophysical properties of advanced carbon materials for Tokamak limiters, 14:32929 (R;US)

GRAPHITE MODERATOR
See GRAPHITE

GRASS
See also CEREALS
Viral Diseases
Evidence implicating a tRNA heritage for the promoters of positive-strand RNA synthesis in brome mosaic and related viruses, 14:32109 (BA;US)

GRASSHOPPERS
Feeding
The effects of atmospheric CO_2 on insect herbivores and their hosts plants: Progress report, 14:31924 (R;US)

GRAVITATION
Testing
A test of Newton's Law of Gravity using the BREN Tower, Nevada, 14:32842 (R;US)

GRAVITATIONAL WAVE DETECTORS
Capacitors
Capacitive device approach to gravitational wave detection, 14:32834 (R;FR)

GREAT BRITAIN
See UNITED KINGDOM

GREEK RESEARCH REACTOR
See DEMOCRITUS REACTOR

GREEN OIL
See SHALE OIL FRACTIONS

GREENHOUSE EFFECT
Detection
Criteria for selecting a CO_2/climate change region of study, 14:31920 (R;US)
Energy Policy
Nuclear power and the greenhouse effect. UKAEA memorandum to the House of Commons Select Committee on Energy, 14:30855 (R;GB)
Evaluation
Beyond CO_2: The other greenhouse gases, 14:31972 (R;US)
Mathematical Models
Cloud albedo, greenhouse effects, atmospheric chemistry, and climate change, 14:31975 (R;US)
Nuclear Power
Nuclear power and the greenhouse effect. UKAEA memorandum to the House of Commons Select Committee on Energy, 14:30855 (R;GB)
Regional Analysis
Climate projections with regional resolution, 14:31976 (R;US)

GREENHOUSES
Geothermal Heating
Greenhouses, 14:30780 (RA;US)
Light Transmission
Light reduction regarding to the greenhouse construction. Average transmission factor for direct light through the greenhouse roof, 14:30755 (R;SE;In Swedish)

GROUND RELEASE
Computerized Simulation
Tritium distribution modeling in a Light Water New Production Reactor, 14:30894 (R;US)

GROUND WATER
Age Estimation
Radioisotope distribution characteristics of the groundwater system in volcanic-type U deposits and isotope-dating estimation of the system, 14:32069 (RA;XA)
Contamination
Development of critical life stage assays: Teratogenic effects of ash basin effluent components on freshwater fish, gambusia affinis and daphnia: Progress report, 21 May 1988–1 June 1989, 14:30275 (R;US)
Hydraulic Conductivity
Application of isotope method in ground water resources investigation, 14:32059 (RA;XA)
Isotope Applications
Use of isotope techniques to investigate saltwater intruded aquifers in the Philippines, 14:32062 (RA;XA)
Isotope Dilution
Application of isotope method in ground water resources investigation, 14:32059 (RA;XA)
Isotope Ratio
Application of S. H. and O. stable isotopes to groundwater research in China, 14:32057 (RA;XA)
Environmental isotope investigation of groundwaters in the region of Taiyuan, Shanxi Province of China, 14:32058 (RA;XA)
Environmental isotope study related to groundwater age, flow system and saline water origin in Quaternary aquifers of North China Plain, 14:32055 (RA;XA)
Environmental isotope-aided studies on river water and groundwater interaction in the region of Seoul and Taegu, 14:32060 (RA;XA)
Study of the groundwater origin in Hebei Plain with isotopic method, 14:32067 (RA;XA)
Mathematical Models
The effect of precipitation on contaminant dissolution and transport: Analytic solutions, 14:30567 (R;US)
Monitoring
40 CFR 265 interim status indicator-evaluation ground-water monitoring plan for the 216-B-63 trench, 14:32001 (R;US)
Natural Radioactivity
Applied research on developing groundwater sources with Po-210 detecting instrument, 14:32070 (RA;XA)
Radioisotope distribution characteristics of the groundwater system in volcanic-type U deposits and isotope-dating estimation of the system, 14:32069 (RA;XA)
Quantitative Chemical Analysis
Environmental isotope-aided studies on water resources in the region of Cheju, 14:32061 (RA;XA)
Quantity Ratio
Environmental isotope-aided studies on water resources in the region of Cheju, 14:32061 (RA;XA)
Resources
Applications of environmental tritium and carbon-14 in water resources investigation in Taiyuan region China, 14:32054 (RA;XA)
Sampling
Borehole summary report for five ground-water monitoring wells constructed in the 1100 Area, 14:31967 (R;US)
Well installation and ground-water sampling plan for 1100 Area environmental monitoring wells, 14:31966 (R;US)
Tracer Techniques
Laboratory studies into the use of the scandium-46-EDTA complex as a tracer for groundwater flow, 14:32066 (RA;XA)
Water Pollution
Fiscal Year 1987 program report: Alaska Water Research Center, 14:32075 (R;US)

GROUND-WATER RESERVES
See AQUIFERS

GROWTH (CRYSTAL)
See CRYSTAL GROWTH

GRR REACTOR
See DEMOCRITUS REACTOR

GUANIDYLAMINOVALERIC ACID
See ARGININE

GUIDELINES
See RECOMMENDATIONS

GUNDREMMINGEN-2 REACTOR
Personnel Dosimetry
Operation experience with an automatic dosimetry system and digitally indicating dosemeters in the Gundremmingen nuclear power plant block B and C, 14:32773 (RA;AT;In German)
Radioactive Effluents
Radiological analysis of the upper Danube river system -a 20 years research programme, 14:32072 (RA;AT;In German)
GUNDREMMINGEN-3 REACTOR
Personnel Dosimetry
Operation experience with an automatic dosimetry system and digitally indicating dosemeters in the Gundremmingen nuclear power plant block B and C, 14:32773 (RA;AT;In German)
Radioactive Effluents
Radiological analysis of the upper Danube river system -a 20 years research programme, 14:32072 (RA;AT;In German)
GUNDREMMINGER KRB REACTOR
See RWE-BAYERNWERK REACTOR
GYPSUM
Hydraulic Fractures
Laboratory observations of the effect of geological discontinuities on hydrofracture propagation, 14:32435 (R;US)
GYROTRONS
See MICROWAVE AMPLIFIERS

H

H CODES
C Codes
Adaptation of HAMMER computer code to CYBER 170/750 computer, 14:32991 (R;BR;In Portuguese)
Implementation
Adaptation of HAMMER computer code to CYBER 170/750 computer, 14:32991 (R;BR;In Portuguese)
HADRON REACTIONS
Fragmentation
Production of light fragments in hA collisions at high energies, 14:32710 (R;XA)
HADRON-HADRON INTERACTIONS
Branching Ratio
Geometrical scaling, furry branching and minijets, 14:32583 (R;US)
Multiple Production
Geometrical model of multiple production, 14:32586 (R;SU)
HAFNIUM
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
HAFNIUM 180
Internal Conversion
Position-sensitive detector for local plane of the beta-spectrometer, 14:31822 (R;SU;In Russian)
Spectra Unfolding
Position-sensitive detector for local plane of the beta-spectrometer, 14:31822 (R;SU;In Russian)
HAFNIUM ALLOYS
Formation Heat
Energetics of transition-metal alloy formation: Ti, Zr, and Hf alloyed with the heavier 4*d* and 5*d* elements, 14:31250 (J;US)
HALIDES
See also CHLORIDES
FLUORIDES
Spectroscopy
Spectroscopy of ionic alkali halide excimers excited by laser-produced plasmas, 14:31641 (BA;US)
HALOGENATED ALIPHATIC HYDROCARBONS
Chemical Properties
Chemical data for predictinng the fate of organic compounds in water: Volume 1, Technical basis: Final report, 14:32035 (R;US)
HAMILTON OPERATORS
See HAMILTONIANS
HAMILTONIANS
Anisotropy
Landau levels and cyclotron masses in Ga Al-Al Ga As quantum wells, 14:32822 (RA;BR)
Feynman Path Integral
Quantization of position dependent hamiltonians in the Feynman path integral formalism, 14:32823 (RA;BR)
Gallium Arsenides
Landau levels and cyclotron masses in Ga Al-Al Ga As quantum wells, 14:32822 (RA;BR)
Quantization
Quantization of position dependent hamiltonians in the Feynman path integral formalism, 14:32823 (RA;BR)
Quantum Mechanics
Landau levels and cyclotron masses in Ga Al-Al Ga As quantum wells, 14:32822 (RA;BR)
Space Dependence
Quantization of position dependent hamiltonians in the Feynman path integral formalism, 14:32823 (RA;BR)
HANDBOOKS
See MANUALS
HANDLING (DATA)
See DATA PROCESSING
HANDLING (WASTES)
See WASTE MANAGEMENT
HANFORD ATOMIC PRODUCTS OPERATION
See HAPO
HANFORD ENGINEERING DEVELOPMENT LABORATORY
Radioactive Waste Facilities
Hanford Waste Vitrification Plant project: an overview, 14:30499 (RA;US)
HANFORD RESERVATION
Health Hazards
Technical basis for internal dosimetry at Hanford, 14:32392 (R;US)
Hydrology
Well installation and ground-water sampling plan for 1100 Area environmental monitoring wells, 14:31966 (R;US)
Occupational Exposure
Hanford Environmental Dose Reconstruction Project: Monthly report, May 1989, 14:32391 (R;US)
Hanford environmental dose reconstruction project: Monthly report, 14:32390 (R;US)
HAPO
Radioactive Effluents
A statistical analysis of measured river contamination at selected shoreline locations, 14:32053 (R;US)
HARBORS
Dredging
Biological testing of sediment for the Olympia Harbor Navigation Improvement Project, 1988: Geoduck, amphipod, and echinoderm bioassays, 14:32046 (R;US)
Sediments
Sources and areal distribution of trace metals in recent sediments of Middle Loch, Pearl Harbor (Hawaii), 14:32038 (R;US)
HARD X RADIATION
Pulsars
Ballon-Borne experiments to study hard x-rays and gamma-rays from SN 1987 A, 14:31795 (RA;BR)
Scintillation Counters
Ballon-Borne experiments to study hard x-rays and gamma-rays from SN 1987 A, 14:31795 (RA;BR)
HARTREE-FOCK-BOGOLYUBOV THEORY
Cranking Model
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)
Woods-Saxon Potential
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)
HAZARDOUS MATERIALS
Aluminium Oxides
Health-hazard evaluation determination report No. 76-33-431, 76-34-431, Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia, 14:31944 (R;US)

Asbestos
Health-hazard evaluation determination report No. 75-121-281, Penn Central Transportation Company, Philadelphia, Pennsylvania, 14:31946 (R;US)

Benzidine
Industrial-hygiene survey, Bachmeier and Company, Kearny, New Jersey, November 4-8, 1985, 14:31952 (R;US)

Beryllium
Health-hazard evaluation determination report No. 75-87-280, Kawecki Berylco Industries, Inc., Reading, PA, 14:31943 (R;US)

Carbon Monoxide
Health-hazard evaluation determination report No. 77-44-435, Keller Columbus, Inc., Columbus, Ohio, 14:31948 (R;US)

Combustion
Juelich Incineration Process for the combustion of hazardous and low level radioactive waste, 14:30484 (RA;US)

Dusts
Health-hazard evaluation determination report No. 75-121-281, Penn Central Transportation Company, Philadelphia, Pennsylvania, 14:31946 (R;US)
Health-hazard evaluation determination report No. 75-19-276, Masonite Corporation, Evendale, Ohio, 14:31959 (R;US)

Glycols
Industrial-hygiene survey report, Cain Chemical, Inc., Bayport Plant, Pasadena, Texas, June 1-2, 1988, 14:31953 (R;US)

Hydrazine
Hydrazine: usage and exposure in the electric power industry, 14:30808 (R;US)

Leaching
40 CFR 265 interim status indicator-evaluation ground-water monitoring plan for the 216-B-63 trench, 14:32001 (R;US)

Lead
Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana, 14:31947 (R;US)
Walk-through survey report, Central Brass Manufacturing Company, Cleveland, Ohio, March 20, 1987, 14:31956 (R;US)

Liquid Wastes
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)

Materials Handling
Countermeasures to hazardous chemicals, 14:31936 (R;US)
Expediting cleanup at the Weldon Spring site under CERCLA and NEPA, 14:32026 (R;US)

Mercury Alloys
Health-hazard evaluation determination report No. 76-6-294, J. A. Devine, D.D.S., Cheyenne, Wyoming, 14:31963 (R;US)

Nitrosamines
Hydrazine: usage and exposure in the electric power industry, 14:30808 (R;US)

Organic Compounds
Annual report on performance-audit results for POHC (Principal Organic Hazardous Constituents) testing during RCRA trial burns, 14:31989 (R;US)

Polycyclic Aromatic Amines
Industrial-hygiene survey report, P. D. George Company, St. Louis, Missouri, February 22-25, 1988, 14:31954 (R;US)
Industrial-hygiene survey report, Wabash Magnetic Company, Huntington, Indiana, May 24-26, 1988 (4,4'-methylenedianiline), 14:31955 (R;US)

Polycyclic Aromatic Hydrocarbons
Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri, 14:31960 (R;US)

Pvc
Health-hazard evaluation determination report No. 73-123-298, Campbell Plastics, Inc., Schenectady, New York, 14:31962 (R;US)

Separation Processes
Cation resins for Cs and Sr removal in the F/H Effluent Treatment Facility, 14:30537 (R;US)

Solvents
Health-hazard evaluation determination report No. 75-146-254, Custom Furniture and Cabinets, Inc., Post Falls, Idaho, 14:31964 (R;US)
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)

Stack Disposal
The potential of continuous emission monitoring of hazardous waste incinerators using Fourier transform infrared spectroscopy, 14:31919 (R;US)

Transportation Systems
Hazardous-materials transportation. January 1977-April 1989 (Citations from the NTIS data base). Report for January 1977-April 1989, 14:30981 (R;US)

Vitrification
In situ vitrification - a status of the technology, 14:30514 (RA;US)

Waste Disposal
Annual report on abandoned or uncontrolled hazardous-waste disposal sites and Hazardous Waste Remedial Fund, 1988, 14:30979 (R;US)
Installation restoration program. Phase 2. Confirmation/quantification stage 2, Moody Air Force Base, Georgia. Appendices. Volume 2. Final report, October 1986-November 1987, 14:32031 (R;US)
Installation-Restoration Program. Phase 2. Confirmation/quantification stage 1 for Minot Air Force Base, Minot, North Dakota. Volume 2. Appendices A through F. Final report, September 1985-October 1988, 14:32032 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)
The destruction of hazardous chemical waste by oxidation in supercritical water, 14:32036 (R;US)

Waste Management
Hanford site waste management units report: Volume 1, 14:30530 (R;US)
Hanford site waste management units report: Volume 2, 14:30531 (R;US)
Hazardous-waste land treatment, 14:31999 (R;US)
Risk-assessment methodology for hazardous-waste management. Final report, 14:31126 (R;US)

HAZARDOUS MATERIALS SPILLS
Environmental Impacts
Installation-Restoration Program. Phase 2. Confirmation/quantification stage 1 for Minot Air Force Base, Minot, North Dakota. Volume 2. Appendices A through F. Final report, September 1985-October 1988, 14:32032 (R;US)

Land Pollution Control
Radio-frequency enhanced decontamination of soils contaminated with halogenated hydrocarbons, 14:31998 (R;US)

HD 8077
See NICKEL BASE ALLOYS

HDO
See DEUTERIUM COMPOUNDS
HEAVY WATER

HEAD
Neoplasms
Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)

HEALTH HAZARDS
Frequency Analysis
Countermeasures to hazardous chemicals, 14:31936 (R;US)

Low Dose Irradiation
Is the objective health detriment an useful concept for evaluating the exposure of a population to ionizing radiation?, 14:32378 (RA;AT)
Mathematical Models
Models for pulmonary lethality and morbidity after irradiation from internal and external sources, 14:30909 (R;US)
Mitigation
Expediting cleanup at the Weldon Spring site under CERCLA and NEPA, 14:32026 (R;US)

HEALTH PHYSICS
See RADIATION PROTECTION

HEART
See also MYOCARDIUM
Grafts
Results of NMR imaging in postsurgical follow-up of heart transplantation patients, 14:32279 (RA;DD;In German)
Nmr Imaging
Contrast-to-noise rate in ECG-triggered fast-field echo sequence, 14:32281 (RA;DD;In German)
Results of NMR imaging in postsurgical follow-up of heart transplantation patients, 14:32279 (RA;DD;In German)
Positron Computed Tomography
Positron emission computed tomography, 14:32354 (BA;US)

HEART DISEASE
See CARDIOVASCULAR DISEASES

HEAT DISTRIBUTION SYSTEMS
Heat Recovery
Aquifer thermal energy storage systems with two aquifers, 14:30929 (RA;CA;In English and French)
Investigation of the vertical flow aquifer thermal energy storage concept and numerical simulation of the Dorigny field experiment, 14:30936 (RA;CA;In English and French)
Mathematical Models
Investigation of the vertical flow aquifer thermal energy storage concept and numerical simulation of the Dorigny field experiment, 14:30936 (RA;CA;In English and French)
Well Spacing
Aquifer thermal energy storage systems with two aquifers, 14:30929 (RA;CA;In English and French)

HEAT ENGINES
See also INTERNAL COMBUSTION ENGINES
Data Base Management
Ceramic Technology for Advanced Heat Engines Project data base: September 1988 summary report, 14:31159 (R;US)
Marketing
Future applications of engine ceramics: Factors influencing market opportunities, timing, and growth, 14:31157 (R;US)

HEAT EXCHANGERS
Eddy Current Testing
Preliminary assessment of an inflatable inspection probe: Phases 1 and 2, 14:30866 (R;US)
Feathers
Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus, 14:30851 (R;BR;In Portuguese)
Fluid Flow
Liquid helium fluid dynamics studies, 14:31596 (R;US)
Lmfbr Type Reactors
Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus, 14:30851 (R;BR;In Portuguese)
Technology Assessment
Heat exchangers, 14:30776 (RA;US)
Thermal Analysis
Numerical analysis of thermal behavior of a heat exchanger made of double-finned annulus, 14:30851 (R;BR;In Portuguese)
Tubes
PWR steam generator tube fretting and fatigue wear: Final report, 14:30839 (R;US)

HEAT FLUX
Air-Water Interactions
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)

HEAT PUMPS
See also AIR SOURCE HEAT PUMPS
CHEMICAL HEAT PUMPS
GAS HEAT PUMPS
SOLAR-ASSISTED HEAT PUMPS
WATER SOURCE HEAT PUMPS
Design
Heat pump - a technical system in progress, 14:31616 (R;SE;In Swedish)
Industrial Plants
Heat pump - a technical system in progress, 14:31616 (R;SE;In Swedish)
Research Programs
Heat pump - a technical system in progress, 14:31616 (R;SE;In Swedish)

HEAT RECOVERY
Waste Heat Utilization
Case-Hoyt/Rochester Corporation printing waste heat recovery project. Final report, 14:31125 (R;US)

HEAT RESISTANT MATERIALS
See also HEAT RESISTING ALLOYS
Thermal-barrier coatings: coating methods, performance, and heat-engine applications. July 1982-April 1989 (Citations from the EI Engineering Meetings data base). Report for July 1982-April 1989, 14:31222 (R;US)
Thermal-insulating coatings. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:31286 (R;US)

HEAT RESISTING ALLOYS
See also ALLOY-ZR98SN-4
STEEL-CR17NI12MO3
STEEL-CR18NI9
STEEL-CR19NI10
STEEL-CR25NI20
Mechanical Properties
Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988, 14:31175 (R;US)

HEAT SINKS
Energy Audits
Open cycle heat pump development for local resource use Phase II district heating case study analysis: Progress report, 1 January 1989–30 March 1989, 14:31137 (R;US)

HEAT SOURCES
Open cycle heat pump development for local resource use Phase II district heating case study analysis: Progress report, 1 January 1989–30 March 1989, 14:31137 (R;US)

HEAT STORAGE
See also SEASONAL THERMAL ENERGY STORAGE
SENSIBLE HEAT STORAGE
Aquifers
Impact of water quality on aquifer thermal energy storage, 14:30943 (RA;CA;In English and French)
Computerized Simulation
Impact of water quality on aquifer thermal energy storage, 14:30943 (RA;CA;In English and French)
Research Programs
The Danish aquifer thermalenergy storage program, 14:30944 (RA;CA;In English and French)
Site Selection
Impact of water quality on aquifer thermal energy storage, 14:30943 (RA;CA;In English and French)
Water Quality
Impact of water quality on aquifer thermal energy storage, 14:30943 (RA;CA;In English and French)

HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT TRANSFER
Computer Architecture
Application of Lotus 1-2-3 to heat transfer analysis, 14:31654 (R;US)

Forecasting
Heat transfer in severe accident simulations, 14:30601 (R;US)
Fuel Channels
Transport coefficients for laminar and turbulent flow through a four-cusp channel, 14:31655 (R;BR)
Laminar Flow
Transport coefficients for laminar and turbulent flow through a four-cusp channel, 14:31655 (R;BR)
Numerical Analysis
Heat-transfer predictions and experiments in a motored engine, 14:31155 (R;US)
Turbulent Flow
Transport coefficients for laminar and turbulent flow through a four-cusp channel, 14:31655 (R;BR)

HEAT TRANSFER FLUIDS
Friction
Friction-reducing additive scale-up experiments in a pilot-scale DHC system simulator, 14:31136 (R;US)

HEAT TRANSMISSION
See HEAT TRANSFER

HEATED EFFLUENTS
See THERMAL EFFLUENTS

HEATING RATE
Numerical Solution
Power plant performance monitoring and improvement: Volume 6, Economic dispatch optimization, 14:30794 (R;US)

HEATING SYSTEMS
See also GEOTHERMAL HEATING SYSTEMS
Design
Greenhouses, 14:30780 (RA;US)
Technology Assessment
Space heating equipment, 14:30777 (RA;US)

HEAVY ION ACCELERATORS
See also BROOKHAVEN RHIC
HILACS
Design
Heavy-ion superconducting linacs, 14:31693 (R;US)
Shielding
Shielding of high energy heavy ion accelerators, 14:31699 (RA;AT)

HEAVY ION FUSION REACTIONS
Meetings
HIF/HIFAR accomplishments: A synopsis (December 1988), 14:32925 (R;US)
Oxygen 16
Observation of sub-barrier fusion enchancement due to negative hexadecapole deformations, 14:32674 (R;AU)

HEAVY ION LINEAR ACCELERATORS
See HILACS

HEAVY ION REACTIONS
See also FLUORINE 19 REACTIONS
KRYPTON 86 REACTIONS
OXYGEN 16 REACTIONS
SILICON 28 REACTIONS
SULFUR 32 REACTIONS
TIN 124 REACTIONS
ZIRCONIUM 96 REACTIONS
Coupled Channel Theory
Two-center effects in nucleon transfer between nuclei, 14:32708 (RA;DE)
Gamma Spectra
Role of pre-equilibrium theory in nuclear data evaluation, 14:32726 (RA;SU)
Neutron Spectra
Role of pre-equilibrium theory in nuclear data evaluation, 14:32726 (RA;SU)
Nuclear Reaction Kinetics
Signatures of nucleon promotion in heavy ion reactions at barrier energies, 14:32709 (RA;DE)
Photoproduction
Photon annd pion production in heavy ion collisions, 14:32740 (R;US)
Pionization
Correlations between dilepton yields and pion multiplicities as probe of the deconfinement transition, 14:32704 (R;DE)

HEAVY IONS
Ganil Cyclotron
Activity report, 14:32650 (R;FR;In French)
Saturne
Activity report, 14:32650 (R;FR;In French)

HEAVY LEPTONS
See also TAU PARTICLES
Particle Production
A search for close-mass lepton doublet, 14:32548 (R;US)

HEAVY NUCLEI
See also IRIDIUM 183
LEAD 204
LEAD 206
LEAD 207
LEAD 208
OSMIUM 192
PLATINUM 194
PLATINUM 196
PLATINUM 198
POLONIUM 218
RADON 213
RADON 222
TANTALUM 182
Excited States
New formulas for systematics of total radiative widths of neutron resonances, 14:32730 (RA;SU;In Russian)
Fast Fission
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
Neutron Reactions
New formulas for systematics of total radiative widths of neutron resonances, 14:32730 (RA;SU;In Russian)

HEAVY OILS
See PETROLEUM

HEAVY WATER
Chemical Reactions
Isotopic dependence of recombination kinetics in water, 14:31573 (J;US)

HEAVY WATER COOLANT
See HEAVY WATER

HEAVY WATER MODERATED REACTORS
See also R-B REACTOR
Reactor Accidents
Preliminary risks associated with postulated tritium release from production reactor operation, 14:32958 (J;US)

HEAVY WATER MODERATOR
See HEAVY WATER

HEDTA
Iron Compounds
Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)
Moessbauer Effect
Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)

HELIUM
Collisions
Surface phonon modes of the RbBr(001) crystal surface by inelastic He-atom scattering, 14:31374 (J;US)
Fluid Mechanics
Liquid helium fluid dynamics studies, 14:31596 (R;US)
Ion-Atom Collisions
Resonant transfer and excitation in collisions of Li-like F^{6+} and Ca^{17+} with light targets, 14:32523 (J;US)
Membrane Transport
Studies on gas transport through dry cellulose acetate membranes prepared by solvent exchange technique, 14:31441 (J;US)
Separation Processes
Advanced gas separation membrane materials: rigid aromatic polyimides, 14:31427 (J;US)

HELIUM 3
Attenuation
Shielding of low-energy cyclotrons, 14:31700 (RA;AT;In German)
HELIUM 3 TARGET
Alpha Reactions
Study on the /sup 3/H + α and /sup 3/He + α elastic scatterings in a state with zero orbital moment, 14:32734 (R;SU)
Helium 3 Reactions
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Linear Momentum Transfer
Study of the electromagnetic response functions and momentum distributions of large linear momentum protons in the helium-3 nucleus using inelastic electron scattering, 14:32651 (R;FR;In French)
Nuclear Structure
Study of the electromagnetic response functions and momentum distributions of large linear momentum protons in the helium-3 nucleus using inelastic electron scattering, 14:32651 (R;FR;In French)
Proton-Nucleon Interactions
Study of the electromagnetic response functions and momentum distributions of large linear momentum protons in the helium-3 nucleus using inelastic electron scattering, 14:32651 (R;FR;In French)
Triton Reactions
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
HELIUM 4
Attenuation
Shielding of low-energy cyclotrons, 14:31700 (RA;AT;In German)
Neutron Diffraction
Final state effects in liquid ^{4}He: An experimental test, 14:32506 (R;US)
Second Sound
Vortex turbulence generated by second sound in superfluid ^{4}He, 14:32539 (J;US)
HELIUM 4 REACTIONS
See ALPHA REACTIONS
HELIUM 4 TARGET
Deuteron Reactions
Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)
Electron Reactions
Two-body electrodisintegration of /sup 4/He studied through the (e,e'X) reaction, 14:32652 (R;NL)
HELIUM PRODUCTION RATES
See GAS PRODUCTION RATES
HEMAGGLUTINATION
See HEMAGGLUTININS
HEMAGGLUTININS
Biochemical Reaction Kinetics
Electrostatics and molecular recognition, 14:32183 (BA;US)
HEMATITE
Leaching
Model for the recovery of titanium from mixtures of ilmenite and hematite by hydrochloric acid leaching, 14:31451 (J;US)
HEMATOPOIETIC SYSTEM
See also BONE MARROW
Radiation Protection
Potential therapeutic applications for interleukin 1: anti-tumor and hematopoietic effects, 14:32364 (R;US)
HEMOGLOBIN
Stereochemistry
Stereochemistry of cooperative mechanisms in hemoglobin, 14:32133 (BA;US)
HERBICIDES
Chemical and biological warfare: defoliants and herbicides. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31474 (R;US)
HETEROCYCLIC COMPOUNDS
See also FURANS
LACTONES
PHTHALOCYANINES
PYRANS
THIOPHENE
Chemical Properties
Chemical data for predictinng the fate of organic compounds in water: Volume 1, Technical basis: Final report, 14:32035 (R;US)
Isomerization
High temperature deviations from Rice–Ramsberger–Kassel–Marcus unimolecular rate coefficients expressions, 14:31480 (J;US)
Photolysis
Phototransformations of benzopyranols and related systems. Steady-state and laser flash photolysis studies, 14:31555 (J;US)
Synthesis
Regioselective synthesis of substituted 1-thiohex-2-enopyranosides, 14:31487 (J;US)
HEXAHYDROPYRIDINES
See PIPERIDINES
HEXANE
Solvent Properties
Heats of dissolution of tar sand bitumen in various solvents, 14:30392 (R;US)
HEXENES
Molecular Structure
Characterization of three-dimensional structures, 14:31478 (BA;US)
HIGGS BOSONS
Rest Mass
The search for a heavy Higgs boson, 14:32580 (R;US)
HIGGS MODEL
Coupling
Higgs coupling and the decoupling theorem, 14:32640 (J;US)
Decoupling
Higgs coupling and the decoupling theorem, 14:32640 (J;US)
HIGH ALLOY STEELS
See also STAINLESS STEELS
Austenite
Use of overlapped reflection for determining the retained austenite by X-ray diffraction, 14:32797 (R;BR;In Spanish)
Martensite
Use of overlapped reflection for determining the retained austenite by X-ray diffraction, 14:32797 (R;BR;In Spanish)
X-Ray Diffraction
Use of overlapped reflection for determining the retained austenite by X-ray diffraction, 14:32797 (R;BR;In Spanish)
HIGH ENERGY PHYSICS
Data Acquisition Systems
[Developments in data acquisition hardware and software, CERN, Geneva, Switzerland, Frankfurt W. Germany, Oxford, UK, April 4-15, 1989]: Foreign trip report, 14:31737 (R;US)
Historical Aspects
After-dinner talk—Reminiscences of a particle physicist, 14:32594 (J;US)
Research Programs
Problems in particle theory: Progress report, April 30, 1988–April 30, 1989, 14:32543 (R;US)
Theoretical high energy physics: Progress report, May 1, 1988–April 30, 1989, 14:32582 (R;US)
Theoretical studies in elementary particle physics: Progress report, March 1988–January 1989, 14:32584 (R;US)
$\bar{p}p$ collider physics, 14:32544 (R;US)
HIGH ENERGY RADIOTHERAPY
See RADIOTHERAPY
HIGH EXPLOSIVES
See CHEMICAL EXPLOSIVES
HIGH FLUX NEUTRON SOURCE FACILITY
See NEUTRON SOURCE FACILITIES
HIGH VOLTAGE ALTERNATING CURRENT SYSTEMS
See HVAC SYSTEMS

HIGH-LEVEL RADIOACTIVE WASTES

Calcination
- High level waste management at the Idaho Chemical Processing Plant, Idaho National Engineering Laboratory, 14:30505 (RA;US)

Corrosion
- Gamma irradiation and in-situ corrosion studies on unalloyed steels for a high level waste packaging in a rock salt repository, 14:30566 (R;DE)

Encapsulation
- Development of a ceramic-based waste form to immobilize ICPP HLW, 14:30516 (RA;US)

Leaching
- Model investigations for trace analysis of iodine, uranium, and technetium in saturated sodium chloride leaching solutions of stored radioactive waste, 14:30565 (R;DE;In German)

Marine Disposal
- A review of near field seawater-sediment interactions with application to the subseabed disposal of nuclear waste, 14:30578 (R;US)

Packaging
- Yucca Mountain Project waste package design for MRS [Monitored Retrievable Storage] system studies, 14:30610 (R;US)

Radioactive Waste Disposal
- Compendium of technical computer codes used in support of the DOE Office of Civilian Radioactive Waste Management, 14:30571 (R;US)

Radioactive Waste Processing
- Evaluation of treatment alternatives for wastes from both spent fuel rod consolidation and miscellaneous commercial activities, 14:30473 (RA;US)
- Multicode comparison of selected source-term computer codes, 14:30569 (R;US)
- Supernatant treatment system at the West Valley Demonstration Project, 14:30460 (RA;US)

Radioactive Waste Storage
- A cask maintenance facility feasibility study, 14:30525 (R;US)
- Comparison of analysis methods for burnup credit applications, 14:30588 (R;US)
- Encapsulated cesium and strontium preliminary description of waste form and canister, 14:30615 (R;US)
- Technical issues affecting the transport of dual purpose casks, 14:30580 (R;US)

Remote Handling
- Remote handling features of the PROTEO mock-up facilities for vitrified H.L.W. canisters, 14:30490 (RA;US)

Transport
- A method for evaluating structural transducers used in Type B package testing, 14:30592 (R;US)
- A source term methodology for spent fuel cask containment evaluations, 14:31606 (R;US)
- Advanced handling technology project and implications for cask design, 14:30595 (R;US)
- An analysis of the consequences of accidents involving shipments of multiple Type A radioactive material (RAM) packages, 14:30594 (R;US)
- An estimate of the contribution of spent fuel products to the releasable source term in spent fuel transport casks, 14:30586 (R;US)
- Dynamic fracture toughness measurements of ferritic ductile cast iron, 14:31604 (R;US)
- Dynamics and static behavior of metal gussets in cask impact limiters, 14:31613 (R;US)
- HTAS2: A three-dimensional transient shipping cask analysis tool, 14:31597 (R;US)
- Impact testing and analysis for structural code benchmarking, 14:31612 (R;US)
- Standard thermal problem set, 14:31611 (R;US)
- The development of a mobile instrumentation data acquisition system for use in cask testing, 14:30593 (R;US)

Underground Disposal
- 3D thermal stress analysis of WIPP room T RH TRU experiments, 14:30584 (R;US)
- Approach to first principles model prediction of measured WIPP [Waste Isolation Pilot Plant] in situ room closure in salt, 14:30582 (R;US)
- Computed and measured responses of a thick-walled hollow cylinder of salt subjected to both homogeneous and inhomogeneous loading, 14:30585 (R;US)
- Experiments in rock mechanics for the site characterization of Yucca Mountain, 14:30583 (R;US)
- Force and moment reconstruction for a nuclear transportation cask using sum of weighted accelerations and deconvolution theory, 14:30602 (R;US)
- Gas generation from the irradiation of mortar, 14:30524 (R;US)
- In-service analysis of cask contamination weeping, 14:31610 (R;US)
- Issues pertinent to sealing of radioactive waste repositories in bedded salt formations, 14:30603 (R;US)
- Leach testing of simulated Hanford Waste Vitrification Plant reference glass HW-39, 14:30573 (R;US)
- Modeling the design and operations of the federal radioactive waste management system, 14:30523 (R;US)
- NNWSI [Nevada Nuclear Waste Storage Investigation] waste form testing at Argonne National Laboratory: Semiannual report, July–December 1987 (Yucca Mountain Project), 14:30611 (R;US)
- NNWSI [Nevada Nuclear Waste Storage Investigations] 51 seismic hole histories, 14:30527 (R;US)
- OGR [Office of Geologic Repositories] repository-specific rod consolidation study: Effect on costs, schedules, and operations at the Yucca Mountain repository, 14:30576 (R;US)
- Office Automation Plan, 14:30535 (R;US)
- Process simulation and statistical approaches for validating waste form qualification models, 14:30572 (R;US)
- Relevance of partial saturation to the mechanical behavior of tuffs, 14:30581 (R;US)
- Results of pressurized-slot measurements in the G-Tunnel underground facility, 14:30589 (R;US)
- The delineation of the disturbed rock zone surrounding excavations in salt, 14:30579 (R;US)
- The effect of precipitation on contaminant dissolution and transport: Analytic solutions, 14:30567 (R;US)
- Thermal analyses of a generic rail cask model and thermal response of a test article using different high temperature boundary conditions, 14:30598 (R;US)
- Waste package performance assessment for the Yucca Mountain Project, 14:30613 (R;US)
- Yucca Mountain Project bibliography, July–December 1988: An update: Civilian Radioactive Waste Management Program, 14:30529 (R;US)

Underground Storage
- Tank farm surveillance and waste status summary report for March 1989, 14:30614 (R;US)

Vitrification
- Advances in vitrification techniques in Japan, 14:30501 (RA;US)
- Design experience of PAMELA, 14:30500 (RA;US)
- Electrode corrosion and ruthenium behavior in a small joule ceramic melter, 14:30519 (RA;US)
- Hanford Waste Vitrification Plant project: an overview, 14:30499 (RA;US)
- High-level liquid waste treatment: process development studies in the WIPE facility, 14:30503 (RA;US)
- Mini-melter studies of high level nuclear waste form development: effects of added nitrates, carbonates and nitrates/formates in the slurry feed, 14:30506 (RA;US)
- Physical modeling test of joule heated ceramic melter system for high level waste vitrification, 14:30517 (RA;US)
- Pilot plant demonstration of the Defense Waste Processing Facility (DWPF) melter concepts, 14:30502 (RA;US)
- Review of research and development of high level liquid waste vitrification in China, 14:30504 (RA;US)
- Savannah River waste glass performance, 14:30513 (RA;US)
- Startup sequence of the DWPF scale glass melter, 14:30518 (RA;US)
- Steam explosions in slurry fed ceramic melters, 14:30508 (RA;US)

The Defense Waste Processing Facility, 14:30617 (BA;US)
Vitrification of sodium-rich high-level waste, 14:30509 (RA;US)
Vitrification plants in France, 14:30497 (RA;US)
Windscale Vitrification Plant and vitrified product store, 14:30498 (RA;US)

HIGH-TEMPERATURE FUEL CELLS
See also MOLTEN CARBONATE FUEL CELLS
Anodes
Metal/zirconia interfacial reactions in solid oxide fuel cell anodes, 14:31048 (BA;US)

HIGH-VOLTAGE PULSE GENERATORS
Design
Design and performance of the 10-kV, 5-MA pulsed-power system for the FRX-C compression experiment, 14:32923 (R;US)

HIGHWAYS
See ROADS

HILACS
Meetings
HIF/HIFAR accomplishments: A synopsis (December 1988), 14:32925 (R;US)

HK 40
See STEEL-CR25NI20

HO2
See HYDROPEROXY RADICALS

HODOSCOPES
Plastic Scintillation Detectors
Fast trigger scintillator for the JETSET experiment (PS202/LEAR), 14:31817 (R;DE;In German)
Uses
Neutron-gamma hodoscope detection of fissile materials, 14:30631 (R;US)

HOG FUEL
See WOOD WASTES

HORIZONTAL AXIS TURBINES
Dynamics
Yaw dynamics of horizontal axis wind turbines: Second annual report, 14:30790 (R;US)

HOT CELLS
Maintenance
Remote maintenance for waste handling: application of servomanipulators to a new generation of hot cells, 14:30438 (RA;US)
Mechanical Structures
Evolution of design concepts for remotely maintainable equipment racks, 14:31590 (RA;US)

HOT GAS CLEANUP
1.0 Million Btu combustor testing: Test results: Part 2, 14:30803 (R;US)

HOT WATER HEATERS
See WATER HEATERS

HTO
See HEAVY WATER

HUGENHOLTZ-PINES THEORY
See HYDROGEN

HUMAN CELLS
See ANIMAL CELLS

HUMAN POPULATIONS
Attitudes
What did they say? on radio and TV about Chernobyl and how did we experience the information?, 14:30923 (R;SE;In Swedish)
Dose Equivalents
Hanford Environmental Dose Reconstruction Project: Monthly report, May 1989, 14:32391 (R;US)
Hanford environmental dose reconstruction project: Monthly report, 14:32390 (R;US)
External Irradiation
Measurements for the estimation of the external doses in Hungary from Chernobyl release, 14:32016 (RA;AT)
Health Hazards
Is the objective health detriment an useful concept for evaluating the exposure of a population to ionizing radiation?, 14:32378 (RA;AT)
Radiation Doses
Assessment of the consequences of a research reactor credible accident release, 14:30913 (RA;AT)
Bikini accident and Chernobyl accident, 14:32389 (RA;AT)
Chernobyl accident and its radiological impact for Austria, 14:30917 (RA;AT;In German)
Measurements of the Research Centre Seibersdorf with regard to the reactor accident at Chernobyl, 14:32015 (RA;AT)
Measurements on internal contamination in Budapest due to the Chernobyl accident, 14:32019 (RA;AT)
Problems of regulating radiation exposure of the public, 14:30912 (RA;AT)
Radiation exposure of the public from operations of ranger uranium mines, 14:30639 (RA;AT)
Radioecological investigations in the Austrian part of the Danube river, 14:32073 (RA;AT)
Radiological analysis of the upper Danube river system -a 20 years research programme, 14:32072 (RA;AT;In German)

HUMANS
See HUMAN POPULATIONS

HVAC SYSTEMS
Power Transmission Lines
Occupational safety and health effects of high-voltage transmission lines, 14:32405 (R;US)

HYBRID RESONANCE
Detection
The search for scalar mesons, 14:32553 (J;US)
Physical Properties
Future opportunities for hadron spectroscopy at the MPS, 14:32567 (J;US)
Summary of the hybrids and exotics sessions, 14:32568 (J;US)

HYCSOS
See CHEMICAL HEAT PUMPS

HYDRATED ELECTRONS
See SOLVATED ELECTRONS

HYDRATES
Efficiency
1.0 Million Btu combustor testing: Test results: Part 2, 14:30803 (R;US)
Electronic Structure
Infrared spectrum of $F^- \times H_2O$, 14:31534 (J;US)

HYDRAULIC CONDUCTIVITY
Measuring Methods
Gamma ray attenuation as a method to determine the water infiltration and redistribution parameters in soil, 14:31814 (RA;BR)

HYDRAULIC RAMS
See PUMPS

HYDRAZINE
Occupational Exposure
Hydrazine: usage and exposure in the electric power industry, 14:30808 (R;US)
Thermodynamic Properties
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)

HYDRIDES
See also BERYLLIUM HYDRIDES
BORON HYDRIDES
LITHIUM HYDRIDES
NITROGEN HYDRIDES
PALLADIUM HYDRIDES
SILANES
Chemical Preparation
Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)
Chemical Reactions
Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)
Decomposition
C-H insertion and π-complex formation reactions of (η^5-C_5Me_5)(PMe_3)Ir with ethylene: an intra- and intermolecular isotope effect study, 14:31525 (J;US)

Nuclear Magnetic Resonance
Characterization of interstitial hydrogen within metal clusters in $Zr_6Cl_{12}H$ and $ZrClO_xH_y$ by solid-state nuclear magnetic resonance, 14:31518 (J;US)
Thin Films
Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)

HYDRIODIC ACID
Decomposition
Studies on a membrane reactor, 14:31490 (J;US)
Dissociation
Determining reaction pathways and spin-orbit populations in the photodissociation of HBr and HI using velocity-aligned Doppler spectroscopy, 14:31563 (J;US)

HYDROBROMIC ACID
Determining reaction pathways and spin-orbit populations in the photodissociation of HBr and HI using velocity-aligned Doppler spectroscopy, 14:31563 (J;US)

HYDROCARBON LOGGING
See GAS METERS

HYDROCARBONS
See also ALKANES
ALKENES
ALKYNES
ANTHRACENE
BENZENE
BENZOPYRENE
NAPHTHALENE
POLYCYCLIC AROMATIC HYDROCARBONS
TETRALIN
TOLUENE
TRIPHENYLENE
Adsorption
Preferential adsorption and selective permeation of alcohol/hydrocarbon mixtures in reverse osmosis, 14:31430 (J;US)
Air Pollution Monitors
Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)
Chemical Reactions
Doubly charged gas-phase heteronuclear cluster ions: synthesis and reaction of $LaFe^{2+}$ with small hydrocarbons, 14:31506 (J;US)
Microemulsions
Transient liquid crystals in a W/O microemulsion, 14:30290 (R;US)

HYDROCHLORIC ACID
Air Pollution Monitors
Evaluation of HCl continuous-emission monitors. Final report, May 1986-May 1987, 14:31949 (R;US)

HYDROCYANIC ACID
Chemical Reaction Kinetics
Energy distribution of the CN products of the H+HCN, H+ClCN, and F+HCN reactions, 14:31544 (J;US)

HYDROELECTRIC POWER
Power Generation
Kokanee stock status and contribution Cabinet Gorge Hatchery, Lake Pend Oreille, Idaho: Annual progress report FY 1988, 14:30679 (R;US)

HYDROELECTRIC POWER PLANTS
See also PUMPED STORAGE POWER PLANTS
SMALL-SCALE HYDROELECTRIC POWER PLANTS
Environmental Impacts
Effects of variation in flow on distributions of northern squawfish in the Columbia River below McNary Dam, 14:30694 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part IV. Estimated total loss and mortality of juvenile salmonids to northern squawfish, walleye, and smallmouth bass, 14:30687 (RA;US)
Pest Control
Behavioural systems to guide or divert fish at hydro-electric facilities, 14:30699 (R;CA)

HYDROELECTRICITY
See HYDROELECTRIC POWER

HYDROGEN
Adsorption
Dynamics of molecular hydrogen adsorbed in CoNa-A zeolite, 14:31545 (J;US)
Rotational states of H_2, HD, and D_2 on graphite, 14:31369 (J;US)
Chemical Bonds
Ab initio molecular orbital study of hydrogen bonding and ion-molecule association in model systems for DNA bases, 14:32187 (BA;US)
Effects of external ions upon proton transfer reactions: H-bonded systems containing HCOOH, 14:32188 (BA;US)
Chemical Reaction Kinetics
Energy distribution of the CN products of the H+HCN, H+ClCN, and F+HCN reactions, 14:31544 (J;US)
Reply to Comment on: Accurate three-dimensional quantum scattering calculations for $F+H_2 \rightarrow HF+H$, 14:31550 (J;US)
Chemisorption
Rotationally inelastic scattering of N_2 from clean and hydrogen covered Pd(111), 14:32807 (J;US)
Corrosion
Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)
Corrosive Effects
Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)
Desorption
Quantum state resolved desorption of CO from solid surfaces: Progress report, 15 June 1988–14 June 1989, 14:31469 (R;US)
Diffusion
Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)
Electrochemistry
Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)
Ion-Molecule Collisions
Electron-electron interactions in transfer and excitation in $F^{8+} \rightarrow H_2$ collisions, 14:32516 (J;US)
Resonant transfer and excitation in collisions of Li-like F^{6+} and Ca^{17+} with light targets, 14:32523 (J;US)
Isotope Effects
C-H insertion and π-complex formation reactions of $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir$ with ethylene: an intra- and intermolecular isotope effect study, 14:31525 (J;US)
Neutron Reactions
Investigation of intermediate neutron interaction with tritium and hydrogen, 14:32653 (RA;SU;In Russian)
Rotational States
Rotational states of H_2, HD, and D_2 on graphite, 14:31369 (J;US)
Trapping
Modulating the composition of a metal/oxide interface and using hydrogen as a probe, 14:31244 (J;US)

HYDROGEN 2
See DEUTERIUM

HYDROGEN 3
See TRITIUM

HYDROGEN BROMIDES
See HYDROBROMIC ACID

HYDROGEN CHLORIDES
See HYDROCHLORIC ACID

HYDROGEN CYANIDES
See HYDROCYANIC ACID

HYDROGEN DEUTERIDE
Adsorption
Rotational states of H_2, HD, and D_2 on graphite, 14:31369 (J;US)
Rotational States
Rotational states of H_2, HD, and D_2 on graphite, 14:31369 (J;US)

HYDROGEN FUEL CELLS
Technology Assessment
Fuel cells for extraterrestrial and terrestrial applications, 14:31053 (J;US)

HYDROGEN FUELS
Safety
Safety evaluation of a prototype hydride-powered underground-mining vehicle. Final report, May 1984-May 1987, 14:32410 (R;US)
HYDROGEN HYDROXIDES
See WATER
HYDROGEN IODIDES
See HYDRIODIC ACID
HYDROGEN IONS 1 MINUS
Photon-Ion Collisions
Observation of multiphoton detachment of the H^- ion, 14:32525 (J;US)
HYDROGEN IONS 1 PLUS
Ion-Atom Collisions
Atomic *K*-, *L*-, and *M*-shell cross sections for ionization by protons: A relativistic Hartree-Slater calculation, 14:32511 (J;US)
K- and *L*-shell ionization cross sections for deuterons calculated in the ECPSSR theory, 14:32512 (J;US)
HYDROGEN ISOTOPES
See also DEUTERIUM
TRITIUM
Containers
A tritium compatible plasma exhaust system for a large tokamak, 14:32942 (J;US)
Diffusion Barriers
Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)
Interactions
Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)
Oxidation
Tritium emissions reduction facility, 14:32935 (J;US)
HYDROGEN NITRATES
See NITRIC ACID
HYDROGEN PEROXIDE
Chemical Reactions
Reactions of low-valent transition-metal complexes with hydrogen peroxide. Are they Fenton-like or not? 1. The case of Cu^{+}_{aq} and Cr^{2+}_{aq}, 14:31501 (J;US)
HYDROGEN PHOSPHATES
See PHOSPHORIC ACID
HYDROGEN PRODUCTION
Partial Oxidation Processes
Electrochemical oxidation of oil shale, 14:30396 (RA;CN)
HYDROGEN PRODUCTION RATES
See GAS PRODUCTION RATES
HYDROGEN SULFATES
See SULFURIC ACID
HYDROGEN SULFIDES
Corrosive Effects
Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)
Mass Transfer
Modeling the simultaneous transport of two acid gases in tertiary amines with reversible reactions, 14:31423 (J;US)
Separation Processes
Gas separation properties of phosphazene polymer membranes, 14:31433 (J;US)
HYDROPEROXY RADICALS
Chemical Reaction Kinetics
Kinetics of the reaction of NO_3 with HO_2, 14:31512 (J;US)
HYDROXY COMPOUNDS
See also ALCOHOLS
OXIMES
OXINE
PHENOLS
Chromatography
Separations of compounds of biological and environmental interest by micellar electrokinetic capillary chromatography, 14:31443 (J;US)
Electronic Structure
Resonance Raman studies of substituent effects on the electronic structure of phenoxyl radicals, 14:31513 (J;US)
Solvent Properties
Monolayer behavior of hydroxyoxime extractants, 14:31419 (J;US)
HYDROXYBENZENE
See PHENOL
HYDROXYETHYLETHYLENEDIAMINETRI-ACETIC ACID
See HEDTA
HYDROXYL IONS
See ANIONS
HYDROXYL RADICALS
Absorption Spectra
Algebraic approach to molecular electronic spectra. I. Energy levels, 14:32509 (J;US)
Chemical Reactions
Isotopic dependence of recombination kinetics in water, 14:31573 (J;US)
Temperature dependence of the rate constants of the reactions of OH radicals with C_2H_2 and C_2D_2 at 1 atm in Ar and from 333 to 1273 K, 14:31528 (J;US)
Intermolecular Forces
Spectroscopic mapping of the OH-Ar van der Waals potential, 14:31519 (J;US)
8-HYDROXYQUINOLINE
See OXINE
HYPERCUBE COMPUTERS
Beta operation: a parallel primitive. Doctoral thesis, 14:32977 (R;US)
Communications
A remote host facility for Intel hypercubes, 14:33007 (R;US)
HYPERSONIC FLOW
Boundary Layers
Studies of the structure of attached and separated regions of viscous/inviscid interaction and the effects of combined surface roughness and blowing in high-Reynolds-number hypersonic flows. Final report, 1 August 1985-1 June 1988, 14:31652 (R;US)
Heat Transfer
Studies of the structure of attached and separated regions of viscous/inviscid interaction and the effects of combined surface roughness and blowing in high-Reynolds-number hypersonic flows. Final report, 1 August 1985-1 June 1988, 14:31652 (R;US)
HYPOPHYSIS
See PITUITARY GLAND

I

IAEA SAFEGUARDS
Political Aspects
International Atomic Energy Aagency safeguards: observations on lessons for verifying a chemical weapons convention, 14:31171 (R;CA)
ICEBERGS
Impact Tests
Feasibility study of full scale iceberg impact tests, 14:31687 (R;CA)
Remote Sensing
Evaluation of two search radar systems for detection of ice masses, 14:31669 (R;CA)
ICRP
Recommendations
Twenty-five years of alara, 14:32381 (RA;AT)
ICRP CRITICAL GROUP
Radiation Doses
Radiation burden of a critical group of children by K-40 taken by food, 14:32383 (RA;AT)
IDAHO CHEMICAL PROCESSING PLANT
Radioactive Waste Facilities
High level waste management at the Idaho Chemical Processing Plant, Idaho National Engineering Laboratory, 14:30505 (RA;US)

IDAHO NATIONAL ENGINEERING LABORATORY
Environmental Impacts
Guidelines for revegetation of disturbed sites at the Idaho National Engineering Laboratory, 14:30622 (R;US)
IDEAL FLOW
Studies of the structure of attached and separated regions of viscous/inviscid interaction and the effects of combined surface roughness and blowing in high-Reynolds-number hypersonic flows. Final report, 1 August 1985-1 June 1988, 14:31652 (R;US)
IEAR-1 REACTOR
Fuel Elements
Measurement of the neutron-spectrum in the IEA-R1 research reactor, 14:30889 (RA;BR)
Neutron Spectra
Measurement of the neutron-spectrum in the IEA-R1 research reactor, 14:30889 (RA;BR)
IGNEOUS ROCKS
Age Estimation
Magmatic and petrologic evolution of the mesozvic vulcanic acid rocks from Piraju-Ourinhos region (SP-PR), 14:32414 (R;BR;In Portuguese)
Isotope Dating
Magmatic and petrologic evolution of the mesozvic vulcanic acid rocks from Piraju-Ourinhos region (SP-PR), 14:32414 (R;BR;In Portuguese)
Petrology
Magmatic and petrologic evolution of the mesozvic vulcanic acid rocks from Piraju-Ourinhos region (SP-PR), 14:32414 (R;BR;In Portuguese)
ILLINIUM
See PROMETHIUM
ILLUMINANCE
Mapping
Development of a second-generation, video-based luminance mapper for daylighting research, 14:31091 (R;US)
ILLUMINATION
See ILLUMINANCE
ILLUMINATION SYSTEMS
See LIGHTING SYSTEMS
ILMENITE
Leaching
Model for the recovery of titanium from mixtures of ilmenite and hematite by hydrochloric acid leaching, 14:31451 (J;US)
Ore Concentrates
Potential of heavy minerals in the Valenca-Itacare, Bahia (Brazil) region - Sampling characterization and ore processing, 14:31388 (R;BR;In Portuguese)
Titanium Oxides
Potential of heavy minerals in the Valenca-Itacare, Bahia (Brazil) region - Sampling characterization and ore processing, 14:31388 (R;BR;In Portuguese)
IMAGE PROCESSING
Algorithms
Two-dimensional phase correction of synthetic aperture radar imagery, 14:31608 (R;US)
Computer Architecture
Imagine: A TACS [Test Analysis Computing System] interactive imaging system, 14:33010 (R;US)
IMAGE SCANNERS
Lasers
High-energy laser-assisted imaging through vaporizing aerosols, 14:31636 (BA;US)
IMMUNOGLOBULINS
Labelling
Antibody-gold cluster conjugates, 14:32177 (P;US)
Labelling of TTHA coupled IgG and MCAb with rare earth radionuclides. I. research on labelling process, 14:31574 (R;AU)
IMPACT TESTS
Evaluation
Design verification testing, 14:30591 (R;US)
Dynamics and static behavior of metal gussets in cask impact limiters, 14:31613 (R;US)
Impact testing and analysis for structural code benchmarking, 14:31612 (R;US)
IMPERFECTIONS
See DEFECTS
IMPURITIES
Trace Amounts
Trace constituents in landfill gas. Task report on corrosion potential. Final report, May 1984-June 1985, 14:30652 (R;US)
INCANDESCENT LAMPS
See LIGHT BULBS
INCIDENTS
See ACCIDENTS
INCINERATION
See COMBUSTION
INCINERATORS
Combustion Products
Evaluation of HCl continuous-emission monitors. Final report, May 1986-May 1987, 14:31949 (R;US)
Design
Selection of materials for Savannah River Site Consolidated Incinerator Facility (CIF) offgas system, 14:30616 (R;US)
Economics
Economics of PVC incineration, 14:30488 (RA;US)
Hazardous Materials
Annual report on performance-audit results for POHC (Principal Organic Hazardous Constituents) testing during RCRA trial burns, 14:31989 (R;US)
Performance Testing
Start-up experience and operations of an incinerator and supercompactor, 14:30489 (RA;US)
Technology Assessment
High temperature slagging incineration - recent operating experience, 14:30493 (RA;US)
KEMA incinerator for radioactive waste, 14:30487 (RA;US)
Licensed centralized low level waste incinerator facility, 14:30485 (RA;US)
INCLUSION COMPLEXES
See CLATHRATES
INCOMPLETE FUSION REACTIONS
The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission, 14:32670 (R;US)
INCOMPRESSIBLE FLOW
Computerized Simulation
A second-order projection method for the incompressible Navier Stokes equations on quadrilateral grids, 14:32529 (R;US)
Dynamics
Domain decomposition algorithms and computational fluid dynamics, 14:32531 (J;US)
INCONEL 600
Wear
PWR steam generator tube fretting and fatigue wear: Final report, 14:30839 (R;US)
INCONEL 617
Creep
Verification of constitutive equations for application at 850/sup 0/C, using the internal stress concept, 14:31214 (R;DE;In German)
Deformation
Verification of constitutive equations for application at 850/sup 0/C, using the internal stress concept, 14:31214 (R;DE;In German)
Fatigue
Verification of constitutive equations for application at 850/sup 0/C, using the internal stress concept, 14:31214 (R;DE;In German)
INCONEL 718
Vacuum Melting
Vacuum arc remelting of Alloy 718, 14:31229 (R;US)
INDEPENDENT-PARTICLE MODEL
See SINGLE-PARTICLE MODEL
INDIUM
Arsenic
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)

Crystal Structure
InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)

Gallium
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)

Gallium Arsenides
InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)
Optical investigation of atomic steps in ultra-thin InGaAs/InP quantum wells grown by vapor levitation epitaxy, 14:31230 (R;BR)

Phosphorus
InGaAs/InP, quantum wells and quantum wires grown by vapor levitation epitaxy using chloride transport, 14:31231 (R;BR)
Optical investigation of atomic steps in ultra-thin InGaAs/InP quantum wells grown by vapor levitation epitaxy, 14:31230 (R;BR)

Quaternary Alloy Systems
Contribution to the study of zinc and cadmium diffusions in InP and In/sub 0,97/ Ga/sub 0,03/ As/sub 0,08/ P/sub 0,92/ quaternary compound, 14:31199 (R;BR;In Portuguese)

Superlattices
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)

INDIUM 115 TARGET
Neutron Reactions
Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)

INDIUM CHLORIDES
Electron Capture Decay
Density-depending time-differential perturbed angular correlation in gas-phase /sup 111/InCl, 14:32665 (R;DE;In German)

INDIUM PHOSPHIDES
Photoluminescence
Photoluminescence in (Ga,In)P at high pressure, 14:31364 (J;US)

INDOOR AIR POLLUTION
Environmental Exposure Pathway
Assessing tap-water contributions to inhalation exposure for volatile organic chemicals, 14:31094 (R;US)

Evaluation
Pollutant evaluation, 14:31081 (R;CA;In English and French)

INDUCED RADIOACTIVITY
See RADIOACTIVITY

INDUSTRIAL PLANTS
See also COAL GASIFICATION PLANTS
ISOTOPE SEPARATION PLANTS
OIL SHALE PROCESSING PLANTS
PETROLEUM REFINERIES
SYNTHETIC FUELS REFINERIES
WASTE PROCESSING PLANTS

Energy Conservation
Proceedings of the France - Korea 2. Joint Seminar on energy conservation vol. 1 et 2, 14:31106 (R;FR)

Energy Efficiency
Report of the Office of Energy. Project evaluation and implementation, 14:30993 (R;US)

Hazardous Materials
Health-hazard evaluation determination report No. 77-44-435, Keller Columbus, Inc., Columbus, Ohio, 14:31948 (R;US)

Risk Assessment
Final report on a study of coherence in acceptability criteria for the technical aspects of risks associated with potentially hazardous installations, 14:30903 (R;FR)

INDUSTRIAL SECTOR
See INDUSTRY

INDUSTRIAL WASTES
See also WHEY

Combustion
Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)

Gasification
Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)

Liquid Metals
Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)

Materials Recovery
Metals recovery from wastes. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:31127 (R;US)

Pollutants
Analytical procedures for environmental quality control. Volume 2. Technical report, 14:32042 (R;US)

Waste Water
Analytical procedures for environmental quality control. Volume 3. Technical report, 14:32043 (R;US)

INDUSTRY
See also AGRICULTURE
CERAMICS INDUSTRY
CHEMICAL INDUSTRY
ELECTRIC POWER INDUSTRY
FOOD INDUSTRY
METAL INDUSTRY
NUCLEAR INDUSTRY
OIL SAND INDUSTRY
OIL SHALE INDUSTRY
PETROLEUM INDUSTRY
PLASTICS INDUSTRY
PRINTING AND PUBLISHING INDUSTRY
WIND POWER INDUSTRY
WOOD PRODUCTS INDUSTRY

Cogeneration
Developing a pricing strategy: the case of nonutility generation, 14:31029 (RA;US)

Energy Conservation
Industrial load management in the Broby area, 14:31031 (R;SE;In Swedish)
Programs in energy conservation: Industrial programs, 14:31109 (R;US)

Heat Sources
Radiant heating potential of Vortek arc lamps, 14:31133 (R;CA)

Load Management
Industrial load management in the Broby area, 14:31031 (R;SE;In Swedish)

Rate Structure
Importance of market segmentation in new service and rate offerings, 14:31023 (RA;US)

INERTIAL CONFINEMENT
Rayleigh-Taylor Instability
Onset of nonlinear saturation for Rayleigh-Taylor growth in the presence of a full spectrum of modes, 14:32894 (J;US)

INERTIAL SEPARATORS
Efficiency
Uranium and zirconium mass transfer testing of 5.5-cm-diam centrifugal contactors, 14:30446 (J;US)

INFORMATION
Technical Writing
Documentation for users: Audience, content, and language, 14:33023 (R;US)

INFORMATION CENTERS
Management
The dynamic duo: New technology and willing staff, 14:32966 (R;US)

INFORMATION SYSTEMS
Automation
Engineering drawing transfer test with Douglas Aircraft Company: MIL-D-28000 Class II (IGES), 14:33024 (R;US)

Computer Networks
The CALS Test Network MIL-D-28000 Class II reference drawing packet: Revision C, 14:33011 (R;US)

Security
Prepositioned shared secret and/or shared control schemes, 14:33022 (R;US)

INFORMATION THEORY
Optimization
Application of neural networks and other machine learning algorithms to DNA sequence analysis, 14:32174 (R;US)

INFRARED RADIATION
Beam Monitoring
Methods and systems for diagnostics of electron bunches by synchrotron radiation in infrared range, 14:31750 (R;SU;In Russian)
Electron Rings
Methods and systems for diagnostics of electron bunches by synchrotron radiation in infrared range, 14:31750 (R;SU;In Russian)

INFRARED SPECTROMETERS
Design
Micropyrolyzer design for infrared spectroscopy applications, 14:31336 (R;US)
Performance
Pulsed molecular-beam, diode-laser spectrometry using rapid scanning techniques, 14:31886 (J;US)
The Far-IR spectra of UO_2, α-U_3O_8, and γ-UO_3 using the light pipe reflection method, 14:32510 (J;US)

INHIBITORS (ENZYME)
See ENZYME INHIBITORS

INHOMOGENEOUS PLASMA
Oscillation Modes
Analytic expression for mode conversion of Langmuir and electromagnetic waves, 14:32537 (J;US)

INJECTION (BEAMS)
See BEAM INJECTION

INJECTION FLUIDS
See DISPLACEMENT FLUIDS

INJECTION WELLS
Evaluation
A mathematical model of fluid flow in the vicinity of a horizontal air-injection well, 14:32033 (R;US)

INORGANIC ION EXCHANGERS
See also ZEOLITES
Adsorption
Inorganic anion exchangers for the treatment of radioactive wastes, 14:30532 (R;GB)

INPUT WELL
See INJECTION WELLS

INSTITUTO DE ENERGIA ATOMICA R1
See IEAR-1 REACTOR

INSTRUMENTS (MEASURING)
See MEASURING INSTRUMENTS

INSULATION (THERMAL)
See THERMAL INSULATION

INSULATORS (ELECTRICAL)
See ELECTRICAL INSULATORS

INSULIN
Molecular Structure
Conformational basis of the receptor-binding potency of normal and mutant insulin molecules with relevance to the pathophysiology of noninsulin dependent diabetes mellitus (NIDDM), 14:32184 (BA;US)

INTEGRALS
Data Covariances
Calculation of nuclear parameters for some heavy isotopes, 14:30858 (R;BR;In Portuguese)
Heavy Nuclei
Calculation of nuclear parameters for some heavy isotopes, 14:30858 (R;BR;In Portuguese)
Weighting Functions
Calculation of nuclear parameters for some heavy isotopes, 14:30858 (R;BR;In Portuguese)

INTEGRATED CIRCUITS
Fabrication
Laser processing, 14:31345 (BA;US)
Radiation Hardening
Development of Radhard VLSI electronics for SSC calorimeters, 14:31800 (R;US)

INTERCALATES
See CLATHRATES

INTERCONNECTED POWER SYSTEMS
Contracts
Bulk power contracts: valuing reliability, 14:31030 (RA;US)

INTERFACES
Hall Effect
Observation of the i = 1/2 fractional quantum Hall plateau in AlGaAs/GaAs/AlGaAs selectively doped double heterostructures, 14:31330 (R;DK)

INTERFACES (EQUIPMENT)
See EQUIPMENT INTERFACES

INTERFERON
Melanomas
Efficacy of alfa-interferon as coadjuvant therapy of melanoma stage II, 14:32218 (RA;BR;In Spanish)

INTERLABORATORY COMPARISONS
Accuracy
Comparison of laboratory performances, 14:32049 (J;US)

INTERMEDIATE MASS NUCLEI
See also COBALT 60
COPPER 67
HAFNIUM 180
IODINE 125
IODINE 131
IRON 57
MOLYBDENUM 99
RUTHENIUM 103
STRONTIUM 90
TECHNETIUM 99
TIN 121
ZINC 68
ZIRCONIUM 91
Energy Levels
Interactions between quasiparticles and phonons in odd-even nuclei in the region of /sup 88/Sr and /sup 90/Zr, 14:32735 (R;DE;In German)
Energy-Level Density
Consistent systematics of energy-level density of nuclei in the range off $40 \leq A \leq 150$, 14:32725 (RA;SU;In Russian)
Excited States
New formulas for systematics of total radiative widths of neutron resonances, 14:32730 (RA;SU;In Russian)
Neutron Reactions
Multistep processes in neutron-induced reactions, 14:32729 (RA;SU)
New formulas for systematics of total radiative widths of neutron resonances, 14:32730 (RA;SU;In Russian)

INTERMEDIATE-LEVEL RADIOACTIVE WASTES
Minimization
Electrical processes for the treatment of liquid wastes, 14:30458 (RA;US)
Radioactive Waste Disposal
Advice on the disposal of radioactive by-products arising in the use of nuclear energy, 14:30575 (R;DD;In German)
Equilibrium leach testing of waste forms containing fuel cladding to evaluate their performance in disposal, 14:30463 (RA;US)
Radioactive Waste Processing
New alternative processes for the treatment of the alkaline solvent wash waste, 14:30456 (RA;US)
Strategy and progress in the treatment of LILW in Italy, 14:30461 (RA;US)
Treatment and handling of intermediate and low level radioactive liquid wastes, 14:30471 (RA;US)
Solidification
Immobilization of medium-level waste at Tokai Reprocessing Plant, 14:30482 (RA;US)
Model B - a new process for solidification of ion-exchange resins and evaporation concentration, 14:30464 (RA;US)

INTERNAL COMBUSTION ENGINES
See also DIESEL ENGINES
GAS TURBINE ENGINES
SPARK IGNITION ENGINES

KIVA-II: A computer program for chemically reactive flows with sprays, 14:31161 (R;US)

Heat Transfer
Heat-transfer predictions and experiments in a motored engine, 14:31155 (R;US)

Mechanical Efficiency
Internal combustion engines. Effect, and diagrammatic calculations, 14:31158 (R;DK;In Danish)

Retrofitting
Proceedings of the fourth Windsor workshop on alternative fuels, 14:31154 (R;CA)

INTERNAL CONTAMINATION
See RADIONUCLIDE KINETICS

INTERNAL CONVERSION
Computer Codes
Incorporation of internal conversion coefficients into the ENSDF data sets, 14:32712 (RA;XA)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)

INTERNAL IRRADIATION
Bioassay
Technical basis for internal dosimetry at Hanford, 14:32392 (R;US)

Genetic Effects
"Normal" tissues from humans exposed to radium contain an alteration in the c-mos locus, 14:32371 (R;US)

Health Hazards
ASA conference on radiation and health: Coolfont 7: Final report, 14:32370 (R;US)

INTERNAL MEDICINE
See MEDICINE

INTERNATIONAL COMMISSION RADIOLOGICAL PROTECTION
See ICRP

INTERPLANETARY SPACE
Cosmic Radiation
Solar-cycle dependence of the radial gradient of cosmic-ray intensity. Progress report for period ending 1988, 14:32441 (R;US)

INTERPOLATION
Algorithms
Nonnegativity-, monotonicity-, or convexity-preserving cubic and quintic hermite interpolation, 14:33017 (J;US)

INTERSTITIALS
Charge States
Charge state stability of interstitial impurities in gallium arsenide, 14:32791 (RA;BR)

Impurities
Charge state stability of interstitial impurities in gallium arsenide, 14:32791 (RA;BR)

INTERUNIVERSITAIR REACTOR INSTITUUT
See IRI

INTRANUCLEAR CASCADES
See NUCLEAR CASCADES

INVERTEBRATES
See also MOLLUSCS

Bioassay
Biological testing of sediment for the Olympia Harbor Navigation Improvement Project, 1988: Geoduck, amphipod, and echinoderm bioassays, 14:32046 (R;US)

INVERTERS
Evaluation
Evaluation of stand-alone inverters for remote applications, 14:30818 (BA;US)

Reliability
Evaluation of stand-alone inverters for remote applications, 14:30818 (BA;US)

INVISCID FLOW
See IDEAL FLOW

IODINE
Computerized Simulation
Iodine severe accident behaviour code IMPAIR 2, 14:30920 (R;CH)

Leaching
Model investigations for trace analysis of iodine, uranium, and technetium in saturated sodium chloride leaching solutions of stored radioactive waste, 14:30565 (R;DE;In German)

IODINE 125
Adsorption
Research on the adsorption of technetium and iodine in some minerals, 14:32006 (R;CN;In Chinese)

IODINE 127 TARGET
Neutron Reactions
Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)

IODINE 131
Body Burden
Is there a measurably higher radiation risk for the personnel of a nuclear therapy station?, 14:32382 (RA;AT;In German)

Fallout
Cesium- and iodine contamination of food in South Tyrol, Italy, 14:32362 (RA;AT;In German)

Intake
Assessment of internal contamination with a whole body counter, 14:31847 (RA;AT)

Radioecological Concentration
/sup 131/I-activity in man's thyroid and /sup 137/Cs-activity in muscle tissue, 14:32014 (RA;AT;In German)
Cesium- and iodine contamination of food in South Tyrol, Italy, 14:32362 (RA;AT;In German)
Measurements on internal contamination in Budapest due to the Chernobyl accident, 14:32019 (RA;AT)
Radiation burden of soil and vegetation in South Tyrol, Italy, after the Chernobyl accident, 14:32020 (RA;AT;In German)
Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)

Stack Disposal
Iodine emission from separations processes and flowsheets for improved emission control, 14:30562 (R;US)

IODINE COMPOUNDS
See also HYDRIODIC ACID

Chemical Reactions
Time-resolved reaction of $O_2(^1\Delta)$ with I^- in aqueous solution, 14:31537 (J;US)

Photolysis
Interaction of halide and pseudohalide ions with triplet benzophenone-4-carboxylate: kinetics and radical yields, 14:31559 (J;US)

IODINE IODIDES
See IODINE

ION BEAMS
See also DEUTERON BEAMS

Beam Emittance
Concepts, features, and design of a sixteen-to-four beam combiner for ILSE [Induction Linac Systems Experiment], 14:32924 (R;US)

Beam Production
Focusing of particle beams using two-stage laser ablation, 14:32517 (J;US)

Beam Transport
Fine focusing of intense heavy ions for the production of hot dense matter, 14:31739 (R;DE;In German)

Focusing
Focusing of particle beams using two-stage laser ablation, 14:32517 (J;US)

Lubricating Properties
Applications of ion beam processes in tribology, 14:31187 (R;US)

ION CLUSTERS
See ION PAIRS

ION EXCHANGE MATERIALS
See also INORGANIC ION EXCHANGERS
ORGANIC ION EXCHANGERS

Comparative Evaluations
Cation resins for Cs and Sr removal in the F/H Effluent Treatment Facility, 14:30537 (R;US)

Efficiency
Multicomponent fixed-bed ion exchange: verification of equilibrium coherence theory, 14:31442 (J;US)

Encapsulation
CEGB experience in immobilizing radioactive resins, sludges, and related wastes, 14:30479 (RA;US)

Performance
Rapid determination of burn-up of nuclear fuel - a possible approach, 14:31447 (J;US)

Performance Testing
Methods for improved radwaste ion-exchange processing, 14:30457 (RA;US)

Solidification
Model B - a new process for solidification of ion-exchange resins and evaporation concentration, 14:30464 (RA;US)
Testing waste forms containing high radionuclide loadings, 14:30468 (RA;US)

ION EXCHANGE MEMBRANES
See ION EXCHANGE MATERIALS
MEMBRANES

ION PAIRS
Gases
Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu, 14:32502 (RA;BR)

Ionization
Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu, 14:32502 (RA;BR)

ION SOURCES
Hydrogen Ions 1 Minus
Negative ion production in pure-hydrogen discharges of surface plasma, 14:32918 (R;SU;In Russian)
Negative ion surface-plasma source for plasma trap injectors development in Novosibirsk, 14:32919 (R;SU;In Russian)
On geometric focusing of negative hydrogen ions in surface-plasma sources, 14:31747 (R;SU;In Russian)

Lifetime
Ion source with increased service life, 14:31748 (R;SU;In Russian)

Performance
Evaluation of pulsed fast-atom bombardment ionization for increased sensitivity of tandem mass spectrometry, 14:31401 (J;US)
Mass and energy selective ion partitioning in a two-section Fourier transform ion cyclotron resonance spectrometer cell, 14:31398 (J;US)

ION-ATOM COLLISIONS
Atomic physics using large electrostatic accelerators, 14:32490 (R;US)

Distorted Wave Theory
Strong potential wave functions with elastic channel distortion, 14:32524 (J;US)

Ionization
Atomic *K*-, *L*-, and *M*-shell cross sections for ionization by protons: A relativistic Hartree-Slater calculation, 14:32511 (J;US)
K- and *L*-shell ionization cross sections for deuterons calculated in the ECPSSR theory, 14:32512 (J;US)

ION-ION COLLISIONS
Carbon 12 Reactions
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)

Carbon 14 Reactions
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)

Nitrogen 15 Reactions
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)

Oxygen 16 Reactions
Resonance in /sup 15/N and /sup 14/C induced reactions, 14:32654 (R;FR)

ION-MOLECULE COLLISIONS
Auger Effect
Electron-electron interactions in transfer and excitation in $F^{8+} \rightarrow H_2$ collisions, 14:32516 (J;US)

IONIC REACTIONS
See CHEMICAL REACTIONS
IONS

IONIZATION
See also PHOTOIONIZATION

Gases
Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu, 14:32502 (RA;BR)

Ion Pairs
Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu, 14:32502 (RA;BR)

Mass Spectroscopy
Identification and rejection of energy-degraded events in gas ionization counters, 14:31802 (R;AU)

IONIZATION CALORIMETERS
See SHOWER COUNTERS

IONIZATION CHAMBERS
Sensitivity
Surface-extended x-ray-absorption fine-structure experiments at atmospheric pressure by means of a photocathode proportional counter with monolayer sensitivity, 14:31890 (J;US)

IONIZING RADIATIONS
See also COSMIC RADIATION
GAMMA RADIATION
X RADIATION

Biological Effects
Molecular characterization of x-ray induced mutations at the HGPRT locus in plateau phase Chinese hamster ovary cells: Effect of dose, dose fractionation, and delayed plating, 14:32393 (R;US)

IONOSPHERE
Fluctuations
Short–time-scale evidence for strong Langmuir turbulence during hf heating of the ionosphere, 14:32480 (J;US)

IONS
See also ALUMINIUM IONS
ANIONS
ATOMIC IONS
CALCIUM IONS
CARBON IONS
CATIONS
CHLORINE IONS
FLUORINE IONS
HEAVY IONS
LEAD IONS
MERCURY IONS
OXYGEN IONS
PHOSPHORUS IONS
POTASSIUM IONS
SCANDIUM IONS
URANIUM IONS
XENON IONS
YTTERBIUM IONS

Long-Range Transport
Studies of the ionic balance of Laflamme Lake in 1985 and 1986, 14:32034 (R;CA;In French)

Production
Identification of ions near HVDC [high-voltage direct-current] transmission lines: Final report, 14:32403 (R;US)

IONS (ATOMIC)
See ATOMIC IONS

IOTA-1440 RESONANCES
See ETA-1440 MESONS

IOWA
Hazardous Materials
Annual report on abandoned or uncontrolled hazardous-waste disposal sites and Hazardous Waste Remedial Fund, 1988, 14:30979 (R;US)

Public Buildings
Energy-management financing for state facilities and public schools, 14:30994 (R;US)

IRI
Environment
Central registration system for on line monitoring of radioactivity concentrations and radiation levels, 14:31833 (RA;AT)

IRIDIUM
Catalytic Effects
Kinetics of CO oxidation on single-crystal Pd, Pt, and Ir, 14:31515 (J;US)
Study of ammonia removal in coal gasification processes: Final report, 14:30249 (R;US)
Fluorescence
Atomic fluorescence yields W/sub M4/, W/sub M5/, W/sub N4/ and W/sub N5/ of the elements Ir,Pt,Au,Th and U, 14:32497 (RA;BR)

IRIDIUM 183
Beta-Plus Decay
Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)
Electron Capture Decay
Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)
Osmium 183
Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)
Platinum 185
Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)
Radioactivity
Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)

IRIDIUM COMPLEXES
Chemical Preparation
Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)
Chemical Reactions
Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)
Decomposition
C-H insertion and π-complex formation reactions of (η^5-C_5Me_5)(PMe_3)Ir with ethylene: an intra- and intermolecular isotope effect study, 14:31525 (J;US)

IRIDIUM OXIDES
Catalytic Effects
Polyelectrolyte-stabilized metal oxide hydrosols as catalysts for the photooxidation of water by zinc porphyrins, 14:31558 (J;US)

IRON
Chemical Bonds
Dependence of Kβ/Kα ratio on the chemical constitution of the atom in Cr, Mn and Fe, 14:32498 (RA;BR)
Corrosion
Investigations of hydrogen generation by iron corrosion under repository conditions, 14:31217 (R;CH;In German)
Membrane Transport
Supported liquid membrane separation of aluminum from copper leaching liquors, 14:31431 (J;US)
X-Ray Emission Analysis
Dependence of Kβ/Kα ratio on the chemical constitution of the atom in Cr, Mn and Fe, 14:32498 (RA;BR)

IRON 54 TARGET
Neutron Reactions
Methods for the calculation of neutron induced reactions, 14:32714 (R;XA)

IRON 56 TARGET
Methods for the calculation of neutron induced reactions, 14:32714 (R;XA)

IRON 57
Moessbauer Effect
Mössbauer spectrometry study of the hyperfine fields and electronic structure of Fe-Co alloys, 14:31251 (J;US)

IRON ALLOYS
See also IRON BASE ALLOYS
MONEL 400
Ductility
Effect of chromium on room temperature ductility and fracture mode in Fe/sub 3/Al, 14:31245 (J;US)
Electronic Structure
Mössbauer spectrometry study of the hyperfine fields and electronic structure of Fe-Co alloys, 14:31251 (J;US)
Grain Refinement
Effects of multiple reductions on grain refinement during hot working of alloy 718, 14:31225 (R;US)
Microstructure
The hot deformation behavior of an as-cast alloy 718 ingot, 14:31226 (R;US)
Molecular Structure
Spin echo NMR of cobalt zeolite catalysts: control of particle size and structure, 14:31249 (J;US)
Plasticity
Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking, 14:31216 (R;US)
Solidification
The solidification metallurgy of Alloy 718 and other Nb-containing superalloys, 14:31227 (R;US)

IRON BASE ALLOYS
See also CAST IRON
STEELS
Corrosion
Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)
Grain Boundaries
Experimental studies of the structure of grain boundaries: Progress report, 14:31191 (R;US)
The structure and properties of grain boundaries in B2 ordered alloys: Progress report, 14:31193 (R;US)
Stress Corrosion
Proceedings: 1986 workshop on advanced high-strength materials, 14:30821 (R;US)

IRON BORIDES
Catalytic Effects
Metallic glasses as selective catalysts for synthesis of hydrocarbon liquids in high sulfur conditions: Final report, January 1–December 31, 1988, 14:30650 (R;US)

IRON CHLORIDES
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)

IRON COMPLEXES
See also FERROCENE
Thermodynamic Properties
Potentiometric determination of the molal formation constants of ferrous acetate complexes in aqueous solutions to high temperature, 14:31538 (J;US)

IRON COMPOUNDS
See also IRON BORIDES
IRON CHLORIDES
IRON OXIDES
IRON SULFIDES
Chemical Preparation
Doubly charged gas-phase heteronuclear cluster ions: synthesis and reaction of $LaFe^{2+}$ with small hydrocarbons, 14:31506 (J;US)
Chemical Reactions
Doubly charged gas-phase heteronuclear cluster ions: synthesis and reaction of $LaFe^{2+}$ with small hydrocarbons, 14:31506 (J;US)
Moessbauer Effect
Moessbauer effect in Fe(III) HEDTA, Fe(III) EDTA, and Fe(III) CDTA compounds, 14:32796 (R;BR;In Portuguese)

IRON OXIDES
See also HEMATITE
ILMENITE
Sorptive Properties
Multicycle testing of zinc ferrite, 14:30250 (R;US)
IRON SULFIDES
See also PYRITE
Oxidation
Acid mine drainage potential of raw, retorted, and combusted Eastern oil shale: Final report, 14:30420 (R;US)
IRON-NICKEL BATTERIES
Performance Testing
Nickel - iron battery, 14:31670 (R;DK;In Danish)
IRRADIATION
See also INTERNAL IRRADIATION
LOW DOSE IRRADIATION
RADICIDATION
Biological Indicators
Dose assessment through micronuclei in irradiated human lymphocytes, 14:32384 (RA;AT)
IRRADIATION DEVICES
Gamma Dosimetry
Dosimetry and irradiation methods for the ANSTO gamma technology research irradiator (GATRI), 14:30643 (R;AU)
IRRADIATION RIGS
See IRRADIATION DEVICES
IRRIGATION
The role of electricity in Pacific Northwest irrigated agriculture: Volume 2, Background materials and support documents: Sections D–G, 14:31108 (R;US)
ISCHEMIA
Nmr Spectra
Influence of pentoxifylline on recovery of rat ischemic kidneys as evidenced by /sup 31/P-NMR spectroscopy, 14:32266 (RA;DD;In German)
ISOCYANATES
Air Pollution
Prevention reference manual; chemical specific. Volume 13. Control of accidental releases of methyl isocyanate. Final report, June 1987-September 1988, 14:31945 (R;US)
ISOCYANIC ACID
Photolysis
Photochemistry of O_3/HNCO mixtures, 14:31562 (J;US)
ISOLATED LOCATIONS
See REMOTE AREAS
ISOMERASES
Biochemical Reaction Kinetics
Crystallography and site-directed mutagenesis of yeast triosephosphate isomerase: what can we learn about catalysis from a simple enzyme?, 14:32139 (BA;US)
S-Adenosylmethionine and the mechanism of hydrogen transfer in the lysine 2,3-aminomutase reaction, 14:32135 (BA;US)
Enzyme Activity
Simultaneous fermentation and isomerization of xylose to ethanol, 14:30669 (RA;US)
Genes
Overproduction of xylose isomerase and control of xy1A copy number in large-scale fermentations of Escherichia coli, 14:30732 (RA;US)
Molecular Structure
Crystallography and site-directed mutagenesis of yeast triosephosphate isomerase: what can we learn about catalysis from a simple enzyme?, 14:32139 (BA;US)
ISOTHIOCYANATES
Photolysis
Interaction of halide and pseudohalide ions with triplet benzophenone-4-carboxylate: kinetics and radical yields, 14:31559 (J;US)
ISOTOPE ENRICHMENT
See ISOTOPE SEPARATION
ISOTOPE SEPARATION
See also LASER ISOTOPE SEPARATION
Training
Fundamentals of uranium enrichment: Part 1, Separation theory: Nuclear fuel cycle training course, 14:30432 (R;US)
Fundamentals of uranium enrichment: Part 3, Advanced separation theory: Multicomponent isotope separation: Nuclear fuel cycle training course, 14:30433 (R;US)
Fundamentals of uranium enrichment: Part 4, Other methods; foreign activities: Nuclear fuel cycle training course, 14:30434 (R;US)
ISOTOPE SEPARATION PLANTS
See also TRITIUM EXTRACTION PLANT
Design
Operation of the TSTA isotope separation system with 100 gram tritium, 14:32963 (J;US)
Laser Mirrors
Continuously deformable mirrors, 14:30642 (BA;US)
ISOTOPES
See also DAUGHTER PRODUCTS
FISSION PRODUCTS
HYDROGEN ISOTOPES
RADIOISOTOPES
Catalogs
Isotopes: Products and services, 14:31575 (R;US)
Production
Proceedings of the DOE workshop on the role of a high-current accelerator in the future of nuclear medicine, 14:32348 (R;US)
ISOTOPIC SEPARATION
See ISOTOPE SEPARATION
ITALY
Radioactive Waste Management
Strategy and progress in the treatment of LILW in Italy, 14:30461 (RA;US)
Seasonal Thermal Energy Storage
Aquifer thermal energy storage experimental project in Italy, 14:30937 (RA;CA;In English and French)

J

J PSI-3097 MESONS
Final-State Interactions
Contribution of the final state interactions to the suppression of the J/PSI meson produced in high-energy nucleus-nucleus collisions, 14:32732 (R;FR)
Nucleon Reactions
Contribution of the final state interactions to the suppression of the J/PSI meson produced in high-energy nucleus-nucleus collisions, 14:32732 (R;FR)
Radiative Decay
On the identification of θ ($f_2(1720)$) as a tensor glueball, 14:32595 (J;US)
J-3105 RESONANCES
See J PSI-3097 MESONS
JAILS
See PUBLIC BUILDINGS
JAPAN
Oil Shale Processing Plants
Development of oil shale retorting plant in Japan. Part II. Operation of the pilot plant, 14:30355 (RA;CN)
Radioactive Waste Facilities
Advances in vitrification techniques in Japan, 14:30501 (RA;US)
JAPANESE ORGANIZATIONS
Research Programs
Impressions of the Japanese Sunshine and Moonlight projects, 14:30989 (R;DK)
JET ENGINE FUELS
Combustion
Fuels combustion research. Final technical report, 1 October 1985-30 September 1988, 14:31579 (R;US)
Organic Compounds
Sorption of selected volatile organic constituents of jet fuels and solvents on natural sorbents from gas and solutions phases. Final report, April 1985-September 1987, 14:30298 (R;US)

Production
New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)
Upgrading Julia Creek shale oil - syncrude or fully refined products, 14:30363 (RA;CN)
JOINTS (ANATOMY)
See BONE JOINTS
JORDAN
Oil Shale Deposits
Current situation with respect to oil shale research and the use of oil shale in the Federal Republic of Germany, 14:30325 (RA;CN)
Oil shale in central Jordan, 14:30327 (RA;CN)
JOSEPHSON JUNCTIONS
Parametric Amplifiers
Chaotic noise in superconducting microbridge 4-photon X-band parametric amplifier, 14:32816 (R;DK)

K

K*-892 MESONS
Physical Properties
Mass dependent fits of the partial wave analysis of the $K^+\bar{K}0\pi-$ system, 14:32559 (J;US)
K*RESONANCES
See STRANGE MESONS
K-1240 RESONANCES
See STRANGE MESONS
K-1871 RESONANCES
See STRANGE MESONS
K-25 PLANT
See ORGDP
K-892 RESONANCES
See K*-892 MESONS
K02
See KAONS NEUTRAL LONG-LIVED
KANSAS CITY PLANT
Water Quality
Annual site environmental report for calendar year 1988, United States Department of Energy, Kansas City Plant, Kansas City, Missouri, 14:31927 (R;US)
KAON MINUS-PROTON INTERACTIONS
Inelastic Scattering
On the identification of θ ($f_2(1720)$) as a tensor glueball, 14:32595 (J;US)
The spectroscopy of mesons containing strange quarks, 14:32551 (J;US)
Particle Production
The strangeonium spectrum seen in Lass; implications for glueball spectroscopy, 14:32558 (J;US)
El_i in hadroproduction, 14:32552 (J;US)
KAON-NUCLEON INTERACTIONS
Lagrangian Function
Effective Lagrangian approach to K^+-nucleon scattering and K^+ photoproduction, 14:32741 (J;US)
KAONS
See also ANTIKAONS
KAONS PLUS
Bound State
KK^- molecules, 14:32597 (J;US)
Particle Decay
Rare K decays and limits on new forces, 14:32581 (R;US)
Photoproduction
Coupling constants in kaon photoproduction, 14:32744 (J;US)
KAONS 2
See KAONS NEUTRAL LONG-LIVED
KAONS NEUTRAL LONG-LIVED
Semileptonic Decay
CP-violating decay $K_L^0 \rightarrow \pi^0 \nu\bar{\nu}$, 14:32609 (J;US)
KAONS PLUS
Particle Decay
Search for violation of time reversal invariance in $K_{\mu 3}$ decays, 14:32545 (R;US)
Photoproduction
Effective Lagrangian approach to K^+-nucleon scattering and K^+ photoproduction, 14:32741 (J;US)
KAPPA-725 RESONANCES
See MESONS
KERMA
Three-Dimensional Calculations
Kerma rates and whole-body absorbed dose rates for immersion in a semi-infinite cloud, 14:32766 (RA;AT)
KERNKRAFTWERK OBRIGHEIM
See OBRIGHEIM REACTOR
KERNKRAFTWERK RWE-BAYERNWERK
See RWE-BAYERNWERK REACTOR
KEROGEN
Pyrolysis
Isothermal pyrolysis gas chromatography for study of hydrocarbon formation kinetics from kerogens, 14:30345 (RA;CN)
Mechanism of hydrocarbon generation from fushun oil shale kerogen as viewed by high field solid state C-13 n.m.r. spectroscopy, 14:30387 (RA;CN)
Structural Chemical Analysis
Investigation of the structure of kerogens based on the oxidation products from multistep alkaline permanganate degradation, 14:30375 (RA;CN)
Structural characterization of the kerogen from Pumpherston oil shale, 14:30376 (RA;CN)
Study on the kinetics of kerogen pyrolysis by means of pressure differential scanning calorimetry, 14:30385 (RA;CN)
KETONES
See also ACETONE
BENZOPHENONE
Chemical Shift
Experimental link between the ^{13}C NMR chemical shift of carbonyl carbons and the energy shifts observed in the n → 3s optical transition of cyclic ketones, 14:31533 (J;US)
Reduction
Metal-ammonia reduction of α-tetralone. Competition between ring reduction, carbonyl reduction, and dimer formation, 14:31495 (J;US)
Removal
Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
Solvent Properties
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)
KICKER MAGNETS
Impedance
Beam impedance of ferrite kicker magnets, 14:31760 (R;US)
KIDNEY STONES
See CALCULI
KIDNEYS
Computerized Tomography
CT and MRI of kidney, adrenal and abdominal lymph nodes, 14:32290 (RA;DD)
Grafts
Comparison between MRI of transplanted kidneys and histological results, 14:32292 (RA;DD)
Dynamic MRI of transplanted kidneys after application of Gd-DTPA, 14:32276 (RA;DD)
Effectivity of perfusion solutions for kidney preservation assessed by means of /sup 31/P-NMR spectroscopy, 14:32271 (RA;DD;In German)
Ischemia
Influence of pentoxifylline on recovery of rat ischemic kidneys as evidenced by /sup 31/P-NMR spectroscopy, 14:32266 (RA;DD;In German)
Nmr Imaging
CT and MRI of kidney, adrenal and abdominal lymph nodes, 14:32290 (RA;DD)
Comparison between MRI of transplanted kidneys and histological results, 14:32292 (RA;DD)
Toxicity
Nephrotoxicity of high doses of contrast media in humans, 14:32274 (RA;DD)

KILNS
Energy Efficiency
Development of technology to utilize existing tobacco kilns and/or tobacco storage barns for curing (drying) and/or storage of other crops, 14:31118 (R;CA)
Monitoring
Development of technology to utilize existing tobacco kilns and/or tobacco storage barns for curing (drying) and/or storage of other crops, 14:31118 (R;CA)
KINASES
See PHOSPHOTRANSFERASES
KINASES (PHOSPHOTRANSFERASES)
See PHOSPHOTRANSFERASES
KINETICS EQUATIONS (REACTOR)
See REACTOR KINETICS EQUATIONS
KLYSTRONS
Anomalous electron loading in SLAC 5045 klystron and relativistic klystron input cavities, 14:31774 (R;US)
Electrical Transients
Transient analysis of multicavity klystrons, 14:31768 (R;US)
Feasibility Studies
Relativistic klystrons, 14:31771 (R;US)
KNOCK-ON ELECTRONS
See ELECTRONS
KOREA (SOUTH)
See REPUBLIC OF KOREA
KRB II-B REACTOR
See GUNDREMMINGEN-2 REACTOR
KRB II-C REACTOR
See GUNDREMMINGEN-3 REACTOR
KRB REACTOR
See RWE-BAYERNWERK REACTOR
KRSKO REACTOR
Environment
Monitoring of the /sup 14/C activity in the environment of the nuclear power plant Krsko in Yugoslavia, 14:30884 (RA;AT)
KRYPTON 86 REACTIONS
Heavy Ion Fusion Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Multi-Nucleon Transfer Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Transfer Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
KRYPTON FLUORIDES
Absorption Spectroscopy
Time-resolved absorption spectroscopy of Kr/sub 2/F(4/sup 2/Γ), 14:31642 (BA;US)
KWO REACTOR
See OBRIGHEIM REACTOR

L

L CODES
Integral Cross Sections
Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections, 14:32995 (R;BR;In Portuguese)
Multigroup Theory
Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections, 14:32995 (R;BR;In Portuguese)
Resonance
Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections, 14:32995 (R;BR;In Portuguese)
L-1770 RESONANCES
See STRANGE MESONS
LABORATORY EQUIPMENT
See also GLOVEBOXES
HOT CELLS
MANIPULATORS
Design
Design and construction of automated freeze-thaw testing equipment for concrete. Final report, 14:31663 (R;CA)
LACTONES
Thermodynamic Properties
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)
LAKES
Ionic Composition
Studies of the ionic balance of Laflamme Lake in 1985 and 1986, 14:32034 (R;CA;In French)
Nitrogen Cycle
Fiscal Year 1987 program report: Alaska Water Research Center, 14:32075 (R;US)
LAMBDA C PLUS BARYONS
Semileptonic Decay
Λ_c^+ production and semileptonic decay in 29-GeV e^+e^- annihilation, 14:32574 (J;US)
LAMBDA-1405 BARYONS
Mass Formulae
Hyperon resonances in the chiral bag model, 14:32612 (J;US)
LAMBDA-1405 RESONANCES
See LAMBDA-1405 BARYONS
LAMBDA-N-2130 DIBARYONS
Mass
Singlet dilambda in the chiral theory, 14:32616 (J;US)
LAMINOGRAPHY
See TOMOGRAPHY
LAMPS
See LIGHT BULBS
LAND FILLS
See SANITARY LANDFILLS
LAND POLLUTION
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)
LAND RECLAMATION
Hazardous-waste land treatment, 14:31999 (R;US)
LANDFILLS
See SANITARY LANDFILLS
LANGMUIR OSCILLATIONS
See PLASMA WAVES
LANGMUIR PROBE
Plasma
Rocket-borne Langmuir probe response to an applied periodic potential, 14:31799 (RA;BR)
Response Functions
Rocket-borne Langmuir probe response to an applied periodic potential, 14:31799 (RA;BR)
Uses
Rocket-borne Langmuir probe response to an applied periodic potential, 14:31799 (RA;BR)
LANGUAGES (PROGRAMMING)
See PROGRAMMING LANGUAGES
LANTHANUM
Resonance Ionization Mass Spectroscopy
Diode laser initiated resonance ionization mass spectrometry of lanthanum, 14:31408 (J;US)

LANTHANUM 139 TARGET
Neutron Reactions
Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)

LANTHANUM CHROMITES
See CHROMIUM OXIDES
LANTHANUM OXIDES

LANTHANUM COMPOUNDS
See also LANTHANUM OXIDES
Chemical Preparation
Doubly charged gas-phase heteronuclear cluster ions: synthesis and reaction of $LaFe^{2+}$ with small hydrocarbons, 14:31506 (J;US)
Chemical Reactions
Doubly charged gas-phase heteronuclear cluster ions: synthesis and reaction of $LaFe^{2+}$ with small hydrocarbons, 14:31506 (J;US)
Crystal-Phase Transformations
Structural phase transformations and superconductivity in $La_{2-x}Ba_xCuO_4$, 14:31303 (J;US)

LANTHANUM OXIDES
Superconductivity
Composition of superconducting $La_2CuO_{4+\delta}$: A superconductor doped by excess oxygen defects, 14:31270 (R;US)
Transition Temperature
Pressure dependence of the superconducting and Neel temperatures in a $La_2CuO_{4+\delta}$ crystal, 14:31305 (J;US)

LASER CAVITIES
Design
High-pressure Ar-Xe waveguide lasers with microwave discharge excitation, 14:31638 (BA;US)
Short-pulse intracavity Raman laser, 14:31639 (BA;US)

LASER ISOTOPE SEPARATION
Optical Systems
Continuously deformable mirrors, 14:30642 (BA;US)

LASER MATERIALS
Fractures
Fracture mechanisms of solid state slab lasers, 14:31647 (BA;US)

LASER MIRRORS
Bibliographies
Laser mirrors. January 1975-August 1987 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for January 1975-August 1987, 14:31629 (R;US)
Laser mirrors. September 1987-April 1989 (Citations from the INSPEC: Information Services for the Physics and Engineering Communities data base). Report for September 1987-April 1989, 14:31630 (R;US)
Electromechanics
Continuously deformable mirrors, 14:30642 (BA;US)

LASER RADIATION
Energy Conversion
Efficient second harmonic conversion of broadband high-peak-power Nd:glass laser radiation using large-aperture KDP crystals in quadrature, 14:32926 (R;US)
Wave Propagation
Atmospheric effects on laser propagation, 14:33031 (R;US)
High-energy laser-assisted imaging through vaporizing aerosols, 14:31636 (BA;US)

LASER-PRODUCED PLASMA
Kinetics
High-pressure Ar-Xe waveguide lasers with microwave discharge excitation, 14:31638 (BA;US)
Thermal Conductivity
Measurements of laser plasma coronal conditions and thermal transport with time-resolved x-ray spectroscopy, 14:32896 (J;US)
Two-Dimensional Calculations
2-D fluid dynamics models for laser driven fusion on IBM 3090 vector multiprocessors, 14:32907 (R;IT)
X-Ray Spectra
Measurements of gain and line broadening in lithiumlike aluminum, 14:32895 (J;US)

LASERS
See also FREE ELECTRON LASERS
GAS LASERS
RING LASERS
SEMICONDUCTOR LASERS
SOLID STATE LASERS
X-RAY LASERS
Design
Absolute intensity, high resolution spectrum of the vortek arc lamp and its spectral match to Nd:YAG bands, 14:31633 (R;US)
Nuclear Industry
Review of the utilization of laser and electron beam methods in the nuclear domain, 14:32784 (R;FR;In French)
Pumping
Fission reactor pumped lasers: History and prospects, 14:31632 (R;US)
Technology Assessment
Application of lasers to CANDU nuclear fuel reprocessing, 14:30439 (RA;US)

LATTICE FIELD THEORY
A systematic study of the Toda lattice, 14:32843 (J;US)
Bag Model
Correlation length and order of the deconfining phase transition, 14:32604 (J;US)
Gauge Invariance
Interpreting four-quark interactions in finite-temperature, SU(2), lattice gauge theory, 14:32641 (J;US)
Preconditioning the Kogut-Susskind fermion matrix, 14:32642 (J;US)
Magnetic Fields
SU(2) lattice gauge theory with an external field, 14:32635 (R;DK)

LAWRENCE BERKELEY LABORATORY
Research Programs
Environmental Research Program: FY 1988 annual report, 14:31931 (R;US)
Environmental research program: FY 1987, annual report, 14:31929 (R;US)

LAWRENCE LIVERMORE LABORATORY
Administrative Procedures
Ventilation survey manual: Revision 1, 14:31093 (R;US)
Progress Report
Energy and Technology Review, February–March 1989, 14:32508 (R;US)
Research Programs
Earth Sciences annual report, 1987, 14:30612 (R;US)
Institutional research and development, FY 1988, 14:30990 (R;US)

LEACHATES
Waste Processing
Leachate treatment. January 1972-April 1989 (Citations from Pollution Abstracts). Report for January 1972-April 1989, 14:32000 (R;US)

LEACHING
Biological Effects
Development of critical life stage assays: Teratogenic effects of ash basin effluent components on freshwater fish, gambusia affinis and daphnia: Progress report, 21 May 1988–1 June 1989, 14:30275 (R;US)
Evaluation
NNWSI [Nevada Nuclear Waste Storage Investigation] waste form testing at Argonne National Laboratory: Semiannual report, July–December 1987 (Yucca Mountain Project), 14:30611 (R;US)

LEAD
Hyperfine Structure
Characterization of several ultraviolet–visible emission lines from a lead hollow-cathode lamp, 14:32515 (J;US)
Interfaces
High-resolution electron microscopy of metal/ceramic interfaces, 14:31186 (R;US)
Oxygen 16 Reactions
Transverse momentum distributions and particle correlations from EMU05, 14:32680 (R;US)

Particulates
Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana, 14:31947 (R;US)
Walk-through survey report, Central Brass Manufacturing Company, Cleveland, Ohio, March 20, 1987, 14:31956 (R;US)
Separation Processes
Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)
Sulfur 32 Reactions
Transverse momentum distributions and particle correlations from EMU05, 14:32680 (R;US)
Total Cross Sections
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
X Radiation
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)

LEAD 204
Isotope Effects
Characterization of several ultraviolet–visible emission lines from a lead hollow-cathode lamp, 14:32515 (J;US)

LEAD 206
Characterization of several ultraviolet–visible emission lines from a lead hollow-cathode lamp, 14:32515 (J;US)

LEAD 207
Characterization of several ultraviolet–visible emission lines from a lead hollow-cathode lamp, 14:32515 (J;US)

LEAD 208
Decay
Electromagnetic decay of 10/sup +/ states and yrast isomers in /sup 208/Pb, 14:32682 (J;NL)
Isotope Effects
Characterization of several ultraviolet–visible emission lines from a lead hollow-cathode lamp, 14:32515 (J;US)

LEAD 208 TARGET
Neutron Reactions
Methods for the calculation of neutron induced reactions, 14:32714 (R;XA)
Proton Reactions
Peaks in the valley: Searching for resonances in large angle exclusive scattering, 14:32565 (J;US)

LEAD IONS
Gases
Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu, 14:32502 (RA;BR)

LEAD OXIDES
Bismuth Additions
Electrocatalysis of anodic oxygen-transfer reactions at doped lead dioxide, 14:31051 (BA;US)
Electrodes
Electrocatalysis of anodic oxygen-transfer reactions at doped lead dioxide, 14:31051 (BA;US)

LEAD TELLURIDES
Layers
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)
P-N Junctions
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)
Tin Compounds
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)

LEAD ZIRCONITE TITANATE
See PZT

LEAD-ACID BATTERIES
Design
Optimization of battery characteristics for urban electric van applications, 14:30964 (BA;US)
Recent developments in advanced lead-acid batteries for electric vehicle propulsion, 14:30965 (BA;US)
Evaluation
Evaluation of advanced lead-acid batteries developed for load-leveling applications, 14:30966 (BA;US)
Optimization
Optimization of battery characteristics for urban electric van applications, 14:30964 (BA;US)
Service Life
Evaluation of advanced lead-acid batteries developed for load-leveling applications, 14:30966 (BA;US)
Optimization of battery characteristics for urban electric van applications, 14:30964 (BA;US)

LEAST SQUARE FIT
Computer Calculations
Solving the non-isothermal kinetic curves of gas-solid reactions by non-linear fitting method, 14:31465 (R;CN;In Chinese)

LEAVES
Quantitative Chemical Analysis
Trace element determinations with synchrotron-induced x-ray emission, 14:31463 (J;US)

LEP STORAGE RINGS
Beam Shaping
Depolarization enhancement due to the energy spread, 14:31719 (R;FR)

LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

LEPTONS
See also ELECTRONS
HEAVY LEPTONS
MUONS
NEUTRINOS
Pair Production
Lepton pair emission as a probe for space-time scenario of quark-hadron phase transition, 14:32733 (R;SU)

LEUKEMIA
Antimitotic Drugs
Changes of the cerebral computed tomogram in children during cytostatic therapy, 14:32247 (RA;DD;In German)

LEVEL DENSITY
See ENERGY LEVELS

LEVEL SCHEMES
See ENERGY LEVELS

LEVITATED TRAINS
Stability
Attractive levitation for high-speed ground transport with large guideway clearance and alternating-gradient stabilization, 14:31593 (R;US)

LIBRARIES
Automation
The dynamic duo: New technology and willing staff, 14:32966 (R;US)

LIGASES
Biological Evolution
Some evolutionary relationships of the primary biological catalysts glutamine synthetase and RuBisCO, 14:32125 (BA;US)
Structure-Activity Relationships
Role of protein folding in the evolution of protein sequences, 14:32131 (BA;US)

LIGHT BULBS
See also FLUORESCENT LAMPS
Uses
Radiant heating potential of Vortek arc lamps, 14:31133 (R;CA)

LIGHT GUIDES
See OPTICAL FIBERS

LIGHT WATER COOLED REACTORS
See WATER COOLED REACTORS

LIGHTING SYSTEMS
Control Equipment
Building and energy-management systems: a user guide, 14:31067 (R;US)
Damage
Did high-altitude EMP [electromagnetic pulse] cause the Hawaiian streetlight incident?, 14:31903 (R;US)

Data Base Management
Roadway lighting equipment management systems. Preliminary review: final report synopsis. [B] User standards for luminaire specifications, vol. 1, 14:31140 (R;CA)
Energy Conservation
Lighting energy conservation from labelling switches - a study. Final report, 14:31065 (R;CA)
Evaluation
Illumination evaluation, 14:31085 (R;CA;In French)
Research Programs
Windows and lighting program: FY 1988, annual report, 14:31069 (R;US)
Switches
Lighting energy conservation from labelling switches - a study. Final report, 14:31065 (R;CA)

LIGHTNING
Lightning: Understanding it and protecting systems from its effects, 14:31677 (R;US)

LIGNIN
Biological Functions
Digestion of pretreated aspen substrates: hydrolysis rates and adsorptive loss of cellulase enzymes, 14:30715 (RA;US)
Chemical Composition
Lignin characterization - a summary progress report, 14:30736 (RA;US)
Dealkylation
Catalyst development for hydrodeoxygenation and dealkylation of lignins for fuels, 14:30735 (RA;US)
Lignin conversion - an overview, 14:30734 (RA;US)
Hydrolysis
Design and testing of an autoclave system for lignin hydrotreating, 14:30737 (RA;US)
Ultrafiltration
Lowering kraft black liquor viscosity of ultrafiltration, 14:31436 (J;US)

LIGNITE
Biodegradation
Microbial screening test for lignite degradation: Final report, 14:30260 (R;US)

LIMESTONE
Compression
Stress induced microcrack geometry at failure in unconfined and confined axial compressive tests, 14:32432 (R;US)

LINACS
See LINEAR ACCELERATORS

LINEAR ACCELERATORS
See also HILACS
LINEAR COLLIDERS
STANFORD LINEAR COLLIDER
Beam Dynamics
On the re-acceleration of bunched beams, 14:31722 (R;US)
Beam Emittance
Longitudinal emittance in high-current ion accelerators, 14:31720 (R;US)
Beam Transport
Tentative design of beam focusing for the AHF linac and transport systems, 14:31757 (R;US)
Computerized Simulation
Numerical simulations of RADLAC, IBEX, Recirc, and PT0 in 1988, 14:31767 (R;US)
Design
High average-power induction linacs, 14:31707 (R;US)
Electron Beams
Assessment of a novel r-f linac amplifier concept. Final report, June 1987-July 1988, 14:31711 (R;US)
Ion Beam Injection
Start-up of the negative ion injector for the meson factory linear accelerator in the Nuclear Research Institute, Academy of Science, USSR, 14:31743 (RA;SU;In Russian)
Ion Beams
Ion induction accelerator with collective focusing (IINDUS), 14:31746 (RA;SU;In Russian)
Time-Of-Flight Method
Use of the delta-t method for setting rf phase and amplitude for the AHF linac, 14:31696 (R;US)

LINEAR COLLIDERS
Design
A new switched power linac structure, 14:31705 (R;US)
Report on the international workshop on next generation linear colliders, 14:31706 (R;US)

LINEAR MOMENTUM
Distribution Functions
Momentum distributions: An overview, 14:32835 (R;US)

LINERS
Performance Testing
Liner-waste compatibility studies for coal-fired power plants, 14:31112 (R;US)

LIOUVILLE EQUATION
See BOLTZMANN-VLASOV EQUATION

LIPASE
Structure-Activity Relationships
Facing up to membranes: structure/function relationships in phospholipases, 14:32122 (BA;US)

LIPASES
See LIPASE

LIPIDS
Metabolism
Role of acyl carrier protein isoforms in plant lipid metabolism: Progress report, 14:32173 (R;US)

LIQUID ASPHALT
See PETROLEUM RESIDUES

LIQUID COLUMN CHROMATOGRAPHY
Efficiency
Experimental characterization of the elution profiles of high concentration chromatographic bands using the analytical solution of the ideal model, 14:31406 (J;US)

LIQUID EFFLUENTS
See LIQUID WASTES

LIQUID FUELS
See also GASOLINE
Production
Batch autoclave tests for the liquefaction of Alberta subbituminous coals: I.G. Farben liquefaction process, 14:30241 (R;CA)

LIQUID METAL COOLANT
See LIQUID METALS

LIQUID METALS
Adiabatic Processes
Thermodynamics of metallic solids and fluids from molecular dynamics, 14:31233 (BA;US)
Laminar Flow
MHD flow in insulating circular ducts for fusion blankets, 14:32898 (R;US)

LIQUID WASTES
See also WASTE WATER
Minimization
Electrical processes for the treatment of liquid wastes, 14:30458 (RA;US)
Radioactive Waste Processing
Design and fabrication experience with the AZTECH radwaste equipment, 14:30472 (RA;US)
Transportable volume reduction bitumen solidification system from design to operation, 14:30467 (RA;US)
Treatment and handling of intermediate and low level radioactive liquid wastes, 14:30471 (RA;US)
Reprocessing
Potentiality of nonorganophosphorus extractants in chemical separations of actinides, 14:30443 (J;US)
Solidification
Immobilization of medium-level waste at Tokai Reprocessing Plant, 14:30482 (RA;US)
Plant for immobilizing low-level aqueous waste in water extendible polymer, 14:30481 (RA;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)

Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)

LIQUIDS
See also COAL LIQUIDS
LIQUID METALS
NATURAL GAS LIQUIDS

Reduction
Metal-ammonia reduction of α-tetralone. Competition between ring reduction, carbonyl reduction, and dimer formation, 14:31495 (J;US)

LITEK LAMP
See FLUORESCENT LAMPS

LITHIUM
Fabrication
EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)

Zirconates
EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)

LITHIUM 6 TARGET
Deuteron Reactions
Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)

Electron Reactions
Electrodisintegration of ^{6}Li studied with the reaction $^{6}Li(e,e'p)$, 14:32660 (J;US)

LITHIUM 7 TARGET
Deuteron Reactions
Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)

Proton Reactions
Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)
Peaks in the valley: Searching for resonances in large angle exclusive scattering, 14:32565 (J;US)

LITHIUM ALLOYS
Hole Mobility
Hall mobility of positive carriers in the semimetallic compound LiGa, 14:31264 (J;US)

Mechanical Properties
Mechanical properties of particulate composites based on a body-centered-cubic Mg-Li alloy containing boron, 14:31241 (J;US)

LITHIUM COMPOUNDS
See also LITHIUM HYDRIDES
LITHIUM OXIDES
LITHIUM SILICATES
LITHIUM SULFIDES

Charged-Particle Transport
Diffusion of tritons, deuterons, and protons in $LiNbO_3$ crystals, 14:31366 (J;US)

Ion Exchange
Multicomponent fixed-bed ion exchange: verification of equilibrium coherence theory, 14:31442 (J;US)

Thermal Conductivity
Effects of fast neutron irradiation on thermal conductivity of Li_2O and $LiAlO_2$, 14:32915 (R;US)

LITHIUM HYDRIDES
Absorption Spectra
Algebraic approach to molecular electronic spectra. I. Energy levels, 14:32509 (J;US)

LITHIUM OXIDES
Thermal Conductivity
Effects of fast neutron irradiation on thermal conductivity of Li_2O and $LiAlO_2$, 14:32915 (R;US)

LITHIUM SILICATES
Mechanical Properties
Mechanical properties of lithium silicates for fusion reactor breeder blankets, 14:32922 (R;DE;In German)

Thermal Shock
Mechanical properties of lithium silicates for fusion reactor breeder blankets, 14:32922 (R;DE;In German)

LITHIUM SULFIDES
Crystal Structure
Structural and NMR study of the lithiated defect thiospinels $Li_xCu_{0.07}[Ti_2]S_4$ ($0 < x < 2$), 14:31481 (J;US)

LITHIUM-CHLORINE BATTERIES
Electrochemistry
Influence of electrolyte density on response of LiCl, 14:30968 (BA;US)

LITHIUM-SULFUR BATTERIES
Reliability
Reliability of Li/SO/sub 2/ cells for long life applications, 14:30963 (BA;US)

LIVER
Diagnosis
Comparison of imaging procedures in the diagnosis of expanding processes of the liver, 14:32222 (RA;DD;In German)

Nmr Imaging
Differential diagnosis of focal hepatic lesions by MR, 14:32223 (RA;DD)
MR diagnosis of the liver - state and prospect, 14:32221 (RA;DD;In German)
Multilayered gradient echo sequence in MRT of focal hepatic lesions, 14:32224 (RA;DD;In German)

Nmr Spectra
Effect of substances shortening the relaxation time on /sup 31/P and /sup 13/C-NMR spectroscopy, 14:32269 (RA;DD;In German)
Experience with /sup 15/N-NMR spectroscopy in animal experiments, 14:32265 (RA;DD;In German)

LIVER CIRRHOSIS
Computerized Tomography
Quantitative evaluation of dynamic computed tomograms in liver cirrhosis, 14:32225 (RA;DD;In German)

LIXIVIATION
See LEACHING

LMFBR TYPE REACTORS
See also SUPER PHENIX REACTOR

Design
Evolution of the liquid metal reactor: The Integral Fast Reactor (IFR) concept, 14:30849 (R;US)

Mixed Oxide Fuels
Mixed oxide fuel development, 14:30850 (R;US)

Nuclear Fuels
Alternative fuels for the French fast breeder reactors programme, 14:30848 (R;FR)

LOAD (DYNAMIC)
See DYNAMIC LOADS

LOADS (STATIC)
See STATIC LOADS

LOCAL GALAXY
See MILKY WAY

LOSS OF FLOW
Source Terms
Assessment of the consequences of a research reactor credible accident release, 14:30913 (RA;AT)

LOW DOSE IRRADIATION
Biological Effects
Alternatives to dose, quality factor and dose equivalent for low level irradiation, 14:32367 (R;US)

LOW INCOME GROUPS
Federal Assistance Programs
A process evaluation of the Iowa partnerships in low-income residential retrofit program, 14:31060 (R;US)

LOW-LEVEL RADIOACTIVE WASTES
Radionuclide correlations in low level waste, 14:30545 (RA;US)

Combustion
Economics of PVC incineration, 14:30488 (RA;US)
High temperature slagging incineration - recent operating experience, 14:30493 (RA;US)
Juelich Incineration Process for the combustion of hazardous and low level radioactive waste, 14:30484 (RA;US)
KEMA incinerator for radioactive waste, 14:30487 (RA;US)
Licensed centralized low level waste incinerator facility, 14:30485 (RA;US)

Extrusion
A process for solidifying sodium nitrate waste in polyethylene, 14:30454 (R;US)
Ground Disposal
Prediction of radiation effects from proposed low-level waste disposal sites in Turkey, 14:32023 (J;US)
Tumulus Disposal Demonstration Project assessment plan for potential worker exposure: Revision 1, 14:30570 (R;US)
Legislation
Passage of the Low-Level Radioactive Waste Act Amendments of 1985, 14:30632 (RA;US)
Marine Disposal
Low-Level Waste Ocean Disposal Program final report: Site characterization of the Pacific Study Area, West Coast, Northern Site (W-N), 14:30577 (R;US)
Minimization
Electrical processes for the treatment of liquid wastes, 14:30458 (RA;US)
Radioactive waste volume reduction program at Brunswick Nuclear Project, 14:30542 (RA;US)
Volume reduction program at Crystal River Unit #3, 14:30547 (RA;US)
Radioactive Waste Disposal
Advice on the disposal of radioactive by-products arising in the use of nuclear energy, 14:30575 (R;DD;In German)
Barnwell disposal site issues - 1985, 14:30549 (RA;US)
Classification system for low level radioactive waste disposal technologies, 14:30546 (RA;US)
Impact of regulations on operation of a LLW burial site, 14:30541 (RA;US)
Materials and degradation modes in an alternative LLW [low-level waste] disposal facility, 14:30455 (R;US)
Physical stability of cement encapsulated low level radwastes, 14:30466 (RA;US)
Workshop on rules for exemption from regulatory control: Proceedings, 14:30634 (R;US)
Radioactive Waste Processing
Design and fabrication experience with the AZTECH radwaste equipment, 14:30472 (RA;US)
Iowa Electric's addition of a low level radwaste processing and storage facility to the Duane Arnold Energy Center, 14:30548 (RA;US)
New alternative processes for the treatment of the alkaline solvent wash waste, 14:30456 (RA;US)
Physical inventory by use of modeling for the tritium aqueous waste recovery system, 14:32952 (J;US)
Radwaste evaporator operating experience at Callaway Nuclear Plant, 14:30551 (RA;US)
Residence time distributions for ETF pH adjustment system, 14:30539 (R;US)
Results of comparison testing of the General Electric and Westinghouse-Hittman compactors, 14:30544 (RA;US)
Start-up experience and operations of an incinerator and supercompactor, 14:30489 (RA;US)
Steam generator chemical cleaning waste processing at Millstone Unit No. 2, 14:30543 (RA;US)
Strategy and progress in the treatment of LILW in Italy, 14:30461 (RA;US)
Treatment and handling of intermediate and low level radioactive liquid wastes, 14:30471 (RA;US)
Regulations
Current regulatory issues, 14:30633 (RA;US)
Research Programs
EPRI 1986 LLW program, 14:30550 (RA;US)
Road Transport
The risks and consequences from the transport of low specific activity materials by truck, 14:30451 (R;US)
Separation Processes
Cation resins for Cs and Sr removal in the F/H Effluent Treatment Facility, 14:30537 (R;US)
Solidification
Development and evaluation of polyethylene as solidification agent for low-level waste, 14:30480 (RA;US)
Model B - a new process for solidification of ion-exchange resins and evaporation concentration, 14:30464 (RA;US)
Plant for immobilizing low-level aqueous waste in water extendible polymer, 14:30481 (RA;US)
Testing waste forms containing high radionuclide loadings, 14:30468 (RA;US)
Source Terms
Source-term development for commercial low-level radioactive waste, 14:30474 (RA;US)
Waste Transportation
Update on 1985 and future transportation issues, 14:30450 (RA;US)
LUMBER INDUSTRY
See WOOD PRODUCTS INDUSTRY
LUMINOUS FLUX DENSITY
See ILLUMINANCE
LUNGS
Computerized Tomography
Diagnosis of pulmonary embolism using CT, 14:32289 (RA;DD;In German)
Possible evaluation of the dignity of pulmonary coin lesions by quantitative CT, 14:32285 (RA;DD;In German)
Thoracical high-resolution CT in pulmonary sarcoidosis, 14:32288 (RA;DD;In German)
Dynamic Function Studies
Prospective study on the behaviour of values obtained by organ function studies, in particular scintiscan studies of pulmonary perfusion, during treatment of little to moderately advanced tuberculosis, shown by X-rays to involve one lobe of the lung, 14:32347 (R;DE;In German)
Emboli
Diagnosis of pulmonary embolism using CT, 14:32289 (RA;DD;In German)
Neoplasms
Validity and reliability of results of epidemiological studies for the estimation of the radiation included lung cancer risk, 14:32380 (RA;AT)
Occupational Exposure
Practical experience with dose measurements in uranium mines, 14:31828 (RA;AT;In German)
Pathological Changes
Possible evaluation of the dignity of pulmonary coin lesions by quantitative CT, 14:32285 (RA;DD;In German)
Respiratory System Diseases
Thoracical high-resolution CT in pulmonary sarcoidosis, 14:32288 (RA;DD;In German)
Scintiscanning
Prospective study on the behaviour of values obtained by organ function studies, in particular scintiscan studies of pulmonary perfusion, during treatment of little to moderately advanced tuberculosis, shown by X-rays to involve one lobe of the lung, 14:32347 (R;DE;In German)
LWR TYPE REACTORS
See WATER COOLED REACTORS
LYMPH NODES
Computerized Tomography
CT and MRI of kidney, adrenal and abdominal lymph nodes, 14:32290 (RA;DD)
Images
Copper-67 labeled porphyrin localization in inflamed tissues, 14:32349 (R;US)
Nmr Imaging
CT and MRI of kidney, adrenal and abdominal lymph nodes, 14:32290 (RA;DD)
LYMPHOBLASTOMAS
See LYMPHOMAS
LYMPHOCYTES
Biological Dosemeters
Estimation of DNA synthesis in lymphocyte as biological indicator in radiation accidents. Final report for the period 1 November 1986 - 30 November 1988, 14:32758 (R;XA)
Chromosomal Aberrations
Development of a system for the automatic analysis of chromosome aberrations, 14:32387 (RA;AT)

Irradiation
Dose assessment through micronuclei in irradiated human lymphocytes, 14:32384 (RA;AT)
LYMPHOGRANULOMAS
See LYMPHOMAS
LYMPHOID CELLS
See LYMPHOCYTES
LYMPHOMAS
Biomedical Radiography
Comparison of CT and lymphography in staging primary malignant lymphomas, 14:32296 (RA;DD;In German)
Computerized Tomography
Comparison of CT and lymphography in staging primary malignant lymphomas, 14:32296 (RA;DD;In German)
Diagnosis of abdominal lymphomas by CT, 14:32297 (RA;DD;In German)
LYSINE
Catabolism
S-Adenosylmethionine and the mechanism of hydrogen transfer in the lysine 2,3-aminomutase reaction, 14:32135 (BA;US)
LYSOZYME
Amino Acid Sequence
Sequence convergence and functional adaptation of stomach lysozymes from foregut fermenters, 14:32167 (BA;US)
Biological Functions
Sequence convergence and functional adaptation of stomach lysozymes from foregut fermenters, 14:32167 (BA;US)

M

M CODES
Crystal and molecular structure of a nickel isobacteriochlorin derived from a chlorophyll, 14:32185 (BA;US)
MULTEQ: Equilibrium of an electrolytic solution with vapor-liquid partitioning and precipitation: Volume 1: User's manual, Revision 1, 14:30838 (R;US)
Comparative Evaluations
Comments on MC/sup 2/-2 and MINX computer codes, 14:32990 (R;BR;In Portuguese)
Cross Sections
Comments on MC/sup 2/-2 and MINX computer codes, 14:32990 (R;BR;In Portuguese)
Generation of one energy group cross section library with MC/sup 2/ computer code, 14:30860 (R;BR;In Portuguese)
One-Group Theory
Generation of one energy group cross section library with MC/sup 2/ computer code, 14:30860 (R;BR;In Portuguese)
M SHELL
Photon Beams
M-shell x-ray fluorescence cross section measurements for some elements with $72 \leq Z \leq 92$ at 5.96 KeV, 14:32494 (RA;BR)
X-Ray Fluorescence Analysis
M-shell x-ray fluorescence cross section measurements for some elements with $72 \leq Z \leq 92$ at 5.96 KeV, 14:32494 (RA;BR)
MA 754
See NICKEL BASE ALLOYS
MA 956
See IRON BASE ALLOYS
MACH NUMBER
Studies of the structure of attached and separated regions of viscous/inviscid interaction and the effects of combined surface roughness and blowing in high-Reynolds-number hypersonic flows. Final report, 1 August 1985-1 June 1988, 14:31652 (R;US)
MAGMA SYSTEMS
Geochemistry
Chemical and mineralogic trends within the Timber Mountain–Oasis Valley caldera complex, Nevada: Evidence for Multiple cycles of chemical evolution in a long-lived silicic magma system, 14:32427 (J;US)
Phenocryst abundances and glass and phenocryst compositions as indicators of magmatic environments of large-volume ash flow sheets in southwestern Nevada, 14:32428 (J;US)
MAGNESIUM 24 TARGET
Deuteron Reactions
Processes of inelastic collision of composite particles with non-spherical nuclei, 14:32736 (R;SU;In Russian)
MAGNESIUM 29
Nuclear Structure
Studies of the T/sub Z/ = 5/2 nuclei /sup 31/Al and /sup 29/Mg, 14:32661 (R;AU)
MAGNESIUM ADDITIONS
Magnetic Properties
Magnetic behavior in Mg-stabilized bcc β-Gd and β-Dy, 14:31254 (J;US)
MAGNESIUM ALLOYS
See also MAGNESIUM ADDITIONS
Electrical Properties
Microscopic real-space approach to the theory of metallic glasses, 14:31248 (J;US)
Mechanical Properties
Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988, 14:31175 (R;US)
Lithium depletion in precipitate free zones (PFZ's) in Al-Li base alloys, 14:31239 (J;US)
Mechanical properties of particulate composites based on a body-centered-cubic Mg-Li alloy containing boron, 14:31241 (J;US)
MAGNESIUM COMPLEXES
Electron Transfer
Effect of triplet spin dynamics memory in electron-transfer reactions. Fourier transform-electron paramagnetic resonance spectroscopy, 14:31565 (J;US)
MAGNESIUM OXIDES
Excitons
Excitonic states in pure and impurity-doped magnesium oxide, 14:31372 (J;US)
MAGNET COILS
Production
[Coil production facilities, Karlsruhe, Germany and Bagneux, France, May 8–10, 1989]: Foreign trip report, 14:31736 (R;US)
MAGNETIC BREMSSTRAHLUNG
See SYNCHROTRON RADIATION
MAGNETIC CIRCUITS
Pulse Shapers
Study on pulse characteristics of belt magnetic circuits made of thin transformer steel, 14:31749 (R;SU;In Russian)
MAGNETIC COILS
See MAGNET COILS
MAGNETIC DISKS
Performance
Attaching IBM-compatible 3380 disks to Cray X-MP, 14:32986 (R;US)
MAGNETIC ENERGY STORAGE
Superconducting magnetic energy storage (SMES). January 1972-April 1989 (Citations from the NTIS database). Report for January 1972-April 1989, 14:31602 (R;US)
Economic Analysis
Demand-side load leveling battery storage at the Princeton Plasma Physics Laboratory, 14:30928 (BA;US)
Feasibility Studies
Demand-side load leveling battery storage at the Princeton Plasma Physics Laboratory, 14:30928 (BA;US)
MAGNETIC FIELDS
Alignment
Aligning the magnetic field of a linear induction accelerator with a low-energy electron beam, 14:31729 (R;US)
Corrections
Passive superconductor: A viable method of controlling magnetization multipoles in the SSC dipole, 14:31766 (R;US)
Rotation
Particle confinement in realistic 3D rotamak equilibria, 14:32892 (J;US)
MAGNETIC GRADIENT ACCELERATORS
Design
The Aspun Project, 14:31694 (R;US)

MAGNETIC ISLANDS
Calculation Methods
Simple method for calculating island widths, 14:32900 (R;US)
Perturbation Theory
Study of magnetic field lines after perturbation of a toroidal field with magnetic surfaces, 14:32869 (R;FR;In French)
MAGNETIC LEVITATED TRAINS
See LEVITATED TRAINS
MAGNETIC MIRROR TYPE REACTORS
See also FIELD-REVERSED MIRROR REACTORS
Electron Loss
Numerical study of gyrophase and time-dependent nonadiabatic electron losses in axially symmetric magnetic mirror fields, 14:32933 (J;US)
MAGNETIC MONOPOLES
On interpretation of the magnetic charge effect on ferromagnetic aerosols, 14:32585 (R;SU)
MAGNETIC SEMICONDUCTORS
Electrophoresis
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Exchange Interactions
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Magnons
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
MAGNETIC STARS
Emission Spectra
Au II in IUE spectra of chemically peculiar stars, 14:32450 (RA;FR)
Gallium
Detected UV variability in the IUE spectra of the Ap-Si star HD 25823, 14:32452 (RA;FR)
Validity of the classification of UV gallium stars, 14:32451 (RA;FR)
Silicon
Detected UV variability in the IUE spectra of the Ap-Si star HD 25823, 14:32452 (RA;FR)
Ultraviolet Spectra
Au II in IUE spectra of chemically peculiar stars, 14:32450 (RA;FR)
Detected UV variability in the IUE spectra of the Ap-Si star HD 25823, 14:32452 (RA;FR)
Validity of the classification of UV gallium stars, 14:32451 (RA;FR)
MAGNETOHYDRODYNAMICS
Program Management
MHD [magnetohydrodynamics] Program Plan, FY 1989, 14:31042 (R;US)
MAGNETS
Design
Magnet design technical report—ITER definition phase, 14:32932 (R;US)
Magnetic properties of the ALS [Advanced Light Source] booster synchrotron engineering model magnets, 14:31761 (R;US)
Magnets for high energy colliders, 14:31770 (R;US)
Fabrication
Construction and test results of the FTU toroidal magnet, 14:32911 (RA;IT)
Testing
Construction and test results of the FTU toroidal magnet, 14:32911 (RA;IT)
MAINTENANCE FACILITIES
Feasibility Studies
A cask maintenance facility feasibility study, 14:30525 (R;US)
MALIGNANCIES
See NEOPLASMS
MALTOSE
Biochemical Reaction Kinetics
Following macromolecular interactions and sugar metabolism using site specific ^{3}H labelling and NMR spectroscopy, 14:32210 (R;US)
MAMMALS
See also CATS
DOGS
PRIMATES
Biological Evolution
Male-driven molecular evolution: a model and nucleotide sequence analysis, 14:32164 (BA;US)
MAMMARY GLANDS
Neoplasms
Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)
MAN
See also MEN
WOMEN
Cold Spring Harbor symposia on quantitative biology: Volume 51, Molecular biology of Homo sapiens, 14:32203 (B;US)
Dna Sequencing
Application of neural networks and other machine learning algorithms to DNA sequence analysis, 14:32174 (R;US)
Nmr Spectra
Current status of in vivo NMR spectroscopy in medicine, 14:32260 (RA;DD)
MANGANESE
Atom Transport
Electrochemical transport of manganese between the flux and the weld metal in submerged arc welding, 14:31275 (R;US)
Chemical Bonds
Dependence of Kβ/Kα ratio on the chemical constitution of the atom in Cr, Mn and Fe, 14:32498 (RA;BR)
Solvent Extraction
Synergistic solvent extraction of manganese by macrocyclic crown ethers in combination with didodecylnaphthalene sulfonic acid: effect of macrocycle substituents, 14:31416 (J;US)
Sorption
Cadmium and manganese sorption by soil macropore linings and fillings, 14:32005 (J;US)
X-Ray Emission Analysis
Dependence of Kβ/Kα ratio on the chemical constitution of the atom in Cr, Mn and Fe, 14:32498 (RA;BR)
MANGANESE 55 TARGET
Neutron Reactions
Radiation capture cross sections for /sup 115/In, /sup 197/Au, /sup 127/I, /sup 139/La, /sup 59/Co, /sup 55/Mn and /sup 63/Cu isotopes, 14:32649 (R;SU;In Russian)
MANGANESE COMPLEXES
Structural Chemical Analysis
Oxomanganese(IV) porphyrins identified by resonance Raman and infrared spectroscopy: weak bonds and the stability of the half-filled t_{2g} subshell, 14:31499 (J;US)
MANGANESE COMPOUNDS
See also MANGANESE OXIDES
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
MANGANESE FLUORIDES
Crystal Field
Crystal-field splitting of core excitons in ionic crystals, 14:31367 (J;US)
MANGANESE OXIDES
Submerged Arc Welding
Electrochemical transport of manganese between the flux and the weld metal in submerged arc welding, 14:31275 (R;US)
MANIPULATORS
Design
Manually-operated vertical articulated manipulator developed for investigation of sub-core regions, 14:31591 (RA;US)
MANITOBA
Budgets
Supplementary information for legislative review, 1988-89 estimates, 14:30998 (R;CA)
Land Leasing
Manitoba surface rights board annual report, 1987-88, 14:30308 (R;CA)

Peat
Peatland inventory of Manitoba. 3. Interlake region using Landsat v thematic mapper, 14:30277 (R;CA)

MANUALS
Ventilation survey manual: Revision 1, 14:31093 (R;US)

MANUFACTURING FACILITIES
See INDUSTRIAL PLANTS

MAPPING (TOPOLOGICAL)
See TOPOLOGICAL MAPPING

MARICULTURE
See AQUACULTURE

MARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS

MARINE VEHICLE ACCIDENTS
See ACCIDENTS

MARS PLANET
Gamma Detection
Scientific considerations in the design of the Mars observer gamma-ray spectrometer, 14:32458 (R;US)

MASS SPECTROSCOPY
Biochemistry
Use of various ionization modes for the study of molecules of biological interest, 14:31384 (R;FR;In French)

Isotope Dilution
Evaluation of the mass spectrometric isotope dilution technique with the addition of two tracers (/sup 233/U and /sup 235/U) in the determination of the concentration and distribution of uranium in minerals, 14:31390 (R;BR;In Portuguese)

MASS TRANSFER
See also ENVIRONMENTAL TRANSPORT

B Codes
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 3, January 1, 1989–March 31, 1989, 14:30274 (R;US)

Tracer Techniques
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)

MASS TRANSIT SYSTEMS
Training manual for methanol-fuel use in transit operations, 14:31097 (R;US)

Financing
Transit management and replacement capital planning. Transportation research record, 14:31101 (R;US)

Fuels
Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988, 14:31098 (R;US)

Planning
Transportation planning and automated guideways. Transportation research record, 14:31103 (R;US)

Research Programs
Analysis of four selected state-transportation coordinated efforts in social services and rural public transportation. Final report, 14:31099 (R;US)
Commuter, regional, and rail transit: research and analysis. Transportation Research Record, 14:31100 (R;US)

MASURIUM
See TECHNETIUM

MATERIALS
See also CARBONACEOUS MATERIALS
COMPOSITE MATERIALS
GRANULAR MATERIALS
HAZARDOUS MATERIALS
HEAT RESISTANT MATERIALS
ION EXCHANGE MATERIALS
LASER MATERIALS
RADIOACTIVE MATERIALS
SEMICONDUCTOR MATERIALS
STEMMING MATERIALS
THERMONUCLEAR REACTOR MATERIALS
TOXIC MATERIALS

Fracture Mechanics
Fracture from an atomistic point of view, 14:31342 (BA;US)

Nuclear Power Plants
Transport, acceptance, storage and handling of the itens of nuclear power plants, 14:32757 (R;BR;In Portuguese)

Radiation Effects
Physics of radiation defects and radiation material science. Scientific-technical collection, 14:31173 (R;SU;In Russian)

Recommendations
Transport, acceptance, storage and handling of the itens of nuclear power plants, 14:32757 (R;BR;In Portuguese)

Research Programs
Metals and Ceramics Division progress report for period ending September 30, 1988, 14:31174 (R;US)

Safety
Transport, acceptance, storage and handling of the itens of nuclear power plants, 14:32757 (R;BR;In Portuguese)

MATERIALS (ANTIFERROMAGNETIC)
See ANTIFERROMAGNETIC MATERIALS

MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS

MATERIALS (FERROMAGNETIC)
See FERROMAGNETIC MATERIALS

MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS

MATERIALS RECOVERY
Bibliographies
Metals recovery from wastes. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:31127 (R;US)

MATERIALS TESTING
See also DESTRUCTIVE TESTING
Generation and detection of a monolayer grating by laser desorption and second-harmonic generation: CO on Ni(111), 14:32805 (J;US)

MATERIALS WORKING
Research Programs
Minutes of the meeting, Metal Forming Modeling Subgroup of IMOG, February 1988, 14:31215 (R;US)

MATHEMATICAL MODELS
See also ATOMIC MODELS
CLIMATE MODELS
COSMOLOGICAL MODELS
STATISTICAL MODELS

Comparative Evaluations
Computed and measured responses of a thick-walled hollow cylinder of salt subjected to both homogeneous and inhomogeneous loading, 14:30585 (R;US)

Evaluation
Assessing tap-water contributions to inhalation exposure for volatile organic chemicals, 14:31094 (R;US)

MAXWELL EQUATIONS
Analytical Solution
New electromagnetic directed energy pulses, 14:32839 (R;US)

Boundary Conditions
Characterization of radiation boundary conditions used in the finite-difference time-domain method, 14:32840 (R;US)

Monte Carlo Method
Neutron and gamma transport in air by TRIPOLI-2 time dependent energy deposition and electron current calculation, 14:32982 (R;FR)

Three-Dimensional Calculations
Neutron and gamma transport in air by TRIPOLI-2 time dependent energy deposition and electron current calculation, 14:32982 (R;FR)

MAXWELL-BOLTZMANN EQUATION
See BOLTZMANN EQUATION

MEAN-FIELD THEORY
Cranking Model
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)

Fermi Gas Model
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)

Woods-Saxon Potential
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)

MEASURING INSTRUMENTS
See also CALORIMETERS
DOSEMETERS
MOISTURE GAGES
RADIOMETRIC GAGES
SPECTROMETERS
SPECTROPHOTOMETERS
THERMOCOUPLES

Comparative Evaluations
Evaluation of the performance characteristics of radon and radon-daughter concentration measurement devices under controlled environmental conditions, 14:30705 (R;US)
Validation of the diffusion-barrier charcoal canister method, 14:31063 (R;US)

Design
A fiber optic test system for quantum efficiency measurements, 14:31875 (R;US)
Development of electret technology to measure indoor radon-daughter concentrations: Final report (Phase 1), 14:31064 (R;US)
The development of a mobile instrumentation data acquisition system for use in cask testing, 14:30593 (R;US)

Operation
A critique of trennschaukel operation, 14:31864 (R;US)

Performance Testing
Evaluation of waveform digitizer systems and components in accordance with IEEE waveform digitizer standards, 14:31676 (R;US)

MECHANICAL ENGINEERING
Abstracts
Technical Abstracts, 1988, 14:31586 (R;US)

MECHANICAL STRUCTURES
Damping
Solution of viscously damped linear systems using a set of load-dependent vectors: Final report, Part II, 14:31621 (RA;US)

Design
Evolution of design concepts for remotely maintainable equipment racks, 14:31590 (RA;US)

Response Functions
A discussion on using Lanczos vectors and Ritz vectors for computing dynamic responses: Final report, Part I, 14:31620 (RA;US)
Structural engineering, mechanics and materials: Final report, 14:31618 (R;US)

MECHANICAL VIBRATIONS
Dynamics
Structural engineering, mechanics and materials: Final report, 14:31618 (R;US)

MEDICAL CENTERS
See MEDICAL ESTABLISHMENTS

MEDICAL ESTABLISHMENTS
Energy Management
Energy-management financing for state facilities and public schools, 14:30994 (R;US)

MEDICAL EXAMINATIONS
Safety Standards
Standardization of x-ray diagnostic irradiation on the basis of control level system, 14:32761 (RA;SU;In Russian)

MEDICINE
See also DENTISTRY
NUCLEAR MEDICINE
VETERINARY MEDICINE

Diagnostic Techniques
Radiation exposure of the population in Federal Republic of Germany from X-ray diagnosis. Trends and alternative diagnostic methods, 14:32350 (RA;AT;In German)

MEDICINES
See DRUGS

MELANOCYTES
See ANIMAL CELLS

MELLITIC ACID
Photolysis
Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid, 14:30447 (J;US)

MELTDOWN
Corium
Validation of core debris/concrete interactions and source term models, 14:30921 (R;US)

Iodine
Iodine severe accident behaviour code IMPAIR 2, 14:30920 (R;CH)

Jets
Behavior of a corium jet in high pressure melt ejection from a reactor pressure vessel, 14:30841 (R;SE)

MEMBRANE PROTEINS
See also RECEPTORS
THYLAKOID MEMBRANE PROTEINS

Molecular Structure
Atomic protein structures reveal basic features of binding of sugars and ionic substrates, and calcium cation, 14:32123 (BA;US)

MEMBRANES
See also CELL MEMBRANES
MENINGES
SUPPORTED LIQUID MEMBRANES

Chemical Preparation
Studies on gas transport through dry cellulose acetate membranes prepared by solvent exchange technique, 14:31441 (J;US)

Efficiency
Advanced gas separation membrane materials: rigid aromatic polyimides, 14:31427 (J;US)
Application of the pH-stat technique in Donnan dialysis: effect of anion invasion in the $CoSO_4$/Nafion 117/H_2SO_4 system, 14:31440 (J;US)
CO_2 separation using facilitated transport ion exchange membranes, 14:31426 (J;US)
Gas separation properties of phosphazene polymer membranes, 14:31433 (J;US)
Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)
Proton-ionizable crown compounds: transport of alkali and alkaline earth cations using proton-ionizable triazolo macrocycles, 14:31439 (J;US)

Fouling
Fouling of thin-channel and tubular membrane modules by dilute suspensions, 14:31435 (J;US)

Performance
Lowering kraft black liquor viscosity of ultrafiltration, 14:31436 (J;US)
Permeation of gas mixtures in cellulose acetate membranes - practical approach to predict the permeation rate CO_2/CH_4 mixture, 14:31457 (J;US)
Separation of liquid solutions by contained liquid membranes, 14:31434 (J;US)
Study of nonsteady-state continuous membrane column for gas separation, 14:31438 (J;US)

Physical Properties
Physico-chemical properties of supported and unsupported γ-Al_2O_3 and TiO_2 ceramic membranes, 14:31432 (J;US)

MEN
Radiotherapy
Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)

MENINGES
Nmr Imaging
Native and contrast medium NMR imaging of meningeal diseases, 14:32244 (RA;DD;In German)

MERCAPTANS
See THIOLS

MERCURY
Pumping
Remote process cell mercury transfer pumps for DWPF, 14:30495 (RA;US)

Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)

MERCURY ALLOYS
Particulates
Health-hazard evaluation determination report No. 76-6-294, J. A. Devine, D.D.S., Cheyenne, Wyoming, 14:31963 (R;US)

MERCURY CHLORIDES
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)

MERCURY COMPOUNDS
See also ORGANIC MERCURY COMPOUNDS
Photolysis
Ultraviolet absorption of the vinyl radical and reaction with oxygen, 14:31567 (J;US)
Separation Processes
Comparison of bulk, emulsion, thin sheet supported, and hollow fiber supported liquid membranes in macrocycle-mediated cation separations, 14:31428 (J;US)

MERCURY IONS
Resonance Fluorescence
Resonance fluorescence and quantum jumps in single atoms: Testing the randomness of quantum mechanics, 14:32844 (J;US)

MESH GENERATION
Algorithms
Adaptive mesh refinement on moving quadrilateral grids, 14:32530 (R;US)

MESIC ATOMS
Does the η meson bind to other hadrons?, 14:32598 (J;US)

MESOATOMS
See MESIC ATOMS

MESON RESONANCES
See MESONS

MESON SPECTROSCOPY
Future opportunities for hadron spectroscopy at the MPS, 14:32567 (J;US)
Spectrometers
The Crystal Barrel at LEAR, 14:31859 (J;US)
The fermilalb E-760 charmonium detector, 14:31857 (J;US)
The use of TPC's as target region detectors in the MPS, 14:31858 (J;US)

MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

MESONS
See also BOTTOMONIUM
CHARMONIUM
STRANGE MESONS
STRANGEONIUM
Detection
Resonance formation in photon-photon collisions, 14:32554 (J;US)
Mass Spectra
The world according to lattice QCD, 14:32636 (J;US)

MESSENGER-RNA
Biological Evolution
Peptide-specific ribosomes, genomic tags, and the origin of the genetic code, 14:32153 (BA;US)
Molecular Structure
Coronavirus: a jumping RNA transcription, 14:32112 (BA;US)
Group II intron self-splicing: development of alternative reaction conditions and identification of a predicted intermediate, 14:32098 (BA;US)
Translational requirement for La Crosse virus S-mRNA synthesis, 14:32114 (BA;US)
Structure-Activity Relationships
Genetic delineation of functional components of the group I intron in the phage T4 td gene, 14:32204 (BA;US)
Long-range intron-exon and intron-intron pairings involved in self-splicing of class II catalytic introns, 14:32206 (BA;US)
Splicing of messenger RNA precursors, 14:32104 (BA;US)

METABOLIC PATHWAYS
See BIOLOGICAL PATHWAYS

METABOLISM
Nmr Imaging
Development of the fields of application of NMR imaging and NMR spectroscopy, 14:32340 (RA;DD;In German)
Nmr Spectra
Development of the fields of application of NMR imaging and NMR spectroscopy, 14:32340 (RA;DD;In German)

METAL INDUSTRY
Dusts
Health-hazard evaluation determination report No. 74-9-174 Wheeling Steel Corporation, Steubenville, Ohio, 14:31961 (R;US)
Hazardous Materials
Health-hazard evaluation determination report No. 74-9-174 Wheeling Steel Corporation, Steubenville, Ohio, 14:31961 (R;US)
Health-hazard evaluation determination report No. 75-87-280, Kawecki Berylco Industries, Inc., Reading, PA, 14:31943 (R;US)
Health-hazard evaluation determination report No. 76-33-431, 76-34-431, Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia, 14:31944 (R;US)
Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana, 14:31947 (R;US)
Walk-through survey report, Central Brass Manufacturing Company, Cleveland, Ohio, March 20, 1987, 14:31956 (R;US)

METALLIC GLASSES
Electrical Properties
Microscopic real-space approach to the theory of metallic glasses, 14:31248 (J;US)

METALLOGRAPHY
Laser Radiation
Laser-written metallization patterns for solar cell applications, 14:31340 (BA;US)
Recent developments in the methods and applications of reactive laser-direct-patterning techniques, 14:31339 (BA;US)

METALLOTHIONEIN
Gene Regulation
Regulation of the rat metallothionein-I gene by sodium butyrate, 14:32199 (J;GB)

METALLURGICAL FLUX
Viscosity
Viscosity effects in selected flux cored arc welding consumables, 14:31338 (R;CA)

METALS
See also ACTINIDES
ALKALI METALS
ALUMINIUM
BISMUTH
CADMIUM
GALLIUM
GERMANIUM
INDIUM
LEAD
LIQUID METALS
MERCURY
SCRAP METALS
TIN
TRANSITION ELEMENTS
ZINC
Biological Functions
Metal ions in proteins: structural and functional roles, 14:32136 (BA;US)
Crack Propagation
A 4-electrode analogue for estimating electrochemical reactions with bare metal surfaces at the crack tip, 14:31243 (J;US)

Electrochemistry
Effects of scratched surfaces on passivation, anodic dissolution and hydrogen evolution kinetics, 14:31237 (BA;US)
Gas Cooling
Kelvin-Helmholtz instability and cooling limitations of a vertical molten sheet confined by alternating magnetic fields, 14:31659 (J;US)
Grain Boundaries
Grain-boundary modeling, 14:31235 (BA;US)
Hall Effect
Low-field Hall effect near the percolation threshold, 14:31255 (J;US)
Interfaces
Forces through epitaxially grown interfaces, 14:31184 (R;US)
Metallography
Laser-written metallization patterns for solar cell applications, 14:31340 (BA;US)
Photochemistry
Enhanced photochemistry on metal surfaces, 14:31234 (BA;US)
Physical Radiation Effects
Radiation effects on metals, alloys and cement, 14:31213 (R;BR)
Radiation effects on metals, alloys and cement, 14:31200 (RA;BR)
Recombination zone of Frenkel pairs in metals, 14:31212 (RA;SU;In Russian)
Research Programs
Metals and Ceramics Division progress report for period ending September 30, 1988, 14:31174 (R;US)
Surface Properties
High-order corrections to the image potential, 14:32815 (J;US)
Trace Amounts
Sources and areal distribution of trace metals in recent sediments of Middle Loch, Pearl Harbor (Hawaii), 14:32038 (R;US)
Wear
Metal wastage in fluidized-bed combustors, 14:30281 (R;US)

METAMORPHIC ROCKS
Age Estimation
Geology and Geochemistry of the Poco de Fora region-Curaca river valley-Bahia-Brazil, 14:32415 (R;BR;In Portuguese)
Geologic Surveys
Geology and Geochemistry of the Poco de Fora region-Curaca river valley-Bahia-Brazil, 14:32415 (R;BR;In Portuguese)

METER WAVE RADIATION
See RADIOWAVE RADIATION

METHANE
Biosynthesis
Methane from partially digested sewage sludge. Final report, 14:30651 (R;US)
Decontamination
Estimating the tritiated hydrocarbon decontamination factor by heavy methane, 14:32939 (J;US)
Hydroxylation
Biomimetic catalysis: Hydroxylation of C_2, C_3, and cycloC_6 hydrocarbons by managanese porphyrin and non-porphyrin catalysts in the presence of monooxygen transfer reagents, 14:30706 (R;US)
Impurities
Trace constituents in landfill gas. Task report on corrosion potential. Final report, May 1984-June 1985, 14:30652 (R;US)
Labelling
Estimating the tritiated hydrocarbon decontamination factor by heavy methane, 14:32939 (J;US)
Membrane Transport
Studies on gas transport through dry cellulose acetate membranes prepared by solvent exchange technique, 14:31441 (J;US)
Osmosis
Permeation of gas mixtures in cellulose acetate membranes - practical approach to predict the permeation rate CO_2/CH_4 mixture, 14:31457 (J;US)
Oxidation
Electrochemical oxidation of methane at metal and oxide electrodes. Annual report, December 1, 1987-December 1, 1988, 14:31046 (R;US)
Photochemical Reactions
Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces, 14:31524 (J;US)
Separation Processes
Advanced gas separation membrane materials: rigid aromatic polyimides, 14:31427 (J;US)

METHANOL FUELS
Proving-ground comparison of M.A.N. methanol and diesel transit buses. Interim report, January-August 1988, 14:31098 (R;US)
Demonstration Programs
Methanol Bus Program data analysis report. Interim report, September 1987-June 1988, 14:31163 (R;US)
Manuals
Training manual for methanol-fuel use in transit operations, 14:31097 (R;US)

METHYL RADICALS
Nucleation
Barriers to the nucleation of methyl groups on the diamond (111) surface, 14:31332 (R;US)

METHYL VIOLOGEN
See BIPYRIDINES

METHYL-FUEL
See ALCOHOLS

METHYLBENZENE
See TOLUENE

METHYLENE CHLORIDE
Solvent Properties
Heats of dissolution of tar sand bitumen in various solvents, 14:30392 (R;US)

METHYLENE RADICALS
Absorption Spectra
Algebraic approach to molecular electronic spectra. I. Energy levels, 14:32509 (J;US)

METHYLIDENE RADICALS
See METHYLENE RADICALS

METROPOLITAN AREAS
See URBAN AREAS

MHD GENERATOR CFFF
Testing
Magnetohydrodynamics Coal-Fired Flow Facility: Quarterly technical progress report, October–December 1988, 14:31041 (R;US)

MICELLAR SYSTEMS
Uses
Reverse micelle supercritical fluid separations, 14:31452 (J;US)

MICROBIAL FLORA
See MICROORGANISMS

MICROCOMPUTERS
See also PERSONAL COMPUTERS
Programming
Software for the Odrenok microcomputer. FORTRAN-1900, 14:32998 (R;SU;In Russian)

MICRODOSIMETRY
Proportional Counters
Radiation protection dosimetry of neutrons and photons at a high energy accelerator using a low pressure proportional counter, 14:31842 (RA;AT)
Tissue-Equivalent Detectors
Radiation protection dosimetry of neutrons and photons at a high energy accelerator using a low pressure proportional counter, 14:31842 (RA;AT)

MICROFLORA
See MICROORGANISMS

MICROORGANISMS
See also BACTERIA
CYANOBACTERIA
YEASTS
Chemical Analysis
Quantification of micro organisms in biofuels - a quick analytical method, 14:31395 (R;SE;In Swedish)

Radioactive Waste Disposal
Micro-organisms and nuclear waste: a neglected problem, 14:30563 (R;GB)

MICROSCOPES
Operation
Compact scanning soft-x-ray microscope using a laser-produced plasma source and normal-incidence multilayer mirrors, 14:31885 (J;US)

MICROWAVE AMPLIFIERS
Operation of a quasioptical gyrotron with variable mirror separation, 14:31889 (J;US)

MICROWAVE EQUIPMENT
See also MICROWAVE AMPLIFIERS
SQUID DEVICES

Design
Pyramidal horns: Part 2, A novel design method for horns of any desired gain and aperture phase error, 14:31868 (R;US)

MICROWAVE POWER TRANSMISSION
Efficiency
Pyramidal horns: Part 1: Simple expressions for directivity as a function of aperture phase error, 14:31867 (R;US)

MIDDLE DISTILLATES
See PETROLEUM DISTILLATES

MIGRATION (RADIONUCLIDE)
See RADIONUCLIDE MIGRATION

MILITARY FACILITIES
Dual-Purpose Power Plants
Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988, 14:31988 (R;US)

Hazardous Materials
Installation restoration program. Phase 2. Confirmation/quantification stage 2, Moody Air Force Base, Georgia. Appendices. Volume 2. Final report, October 1986-November 1987, 14:32031 (R;US)
Installation-Restoration Program. Phase 2. Confirmation/quantification stage 1 for Minot Air Force Base, Minot, North Dakota. Volume 2. Appendices A through F. Final report, September 1985-October 1988, 14:32032 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)

Hazardous Materials Spills
Installation-Restoration Program. Phase 2. Confirmation/quantification stage 1 for Minot Air Force Base, Minot, North Dakota. Volume 2. Appendices A through F. Final report, September 1985-October 1988, 14:32032 (R;US)

MILK
Contamination
Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)

MILKY WAY
Stars
Mass distribution in the galactic centre estimated from OH/IR stars, 14:32460 (R;SE)

MILL TAILINGS
Remedial Action
Results of the independent verification of radiological remedial action at 480 South Main Street, Monticello, Utah (MS00049), 14:32022 (R;US)

MINE-MOUTH GENERATING PLANTS
See COAL MINES
FOSSIL-FUEL POWER PLANTS

MINERALS
See also PHOSPHATE MINERALS
ZEOLITES

Catalytic Effects
Dependence of the yield and properties of semicoking oils on the mineral content and composition of oil shales, 14:30388 (RA;CN)

Chemical Reactions
Coal Combustion Science quarterly progress report, October–December 1988, 14:30282 (R;US)

Energy-Loss Spectroscopy
Electron Energy-Loss Spectroscopy: Fundamentals and applications in the characterization of minerals, 14:31394 (R;US)

Quantitative Chemical Analysis
Trace element determinations with synchrotron-induced x-ray emission, 14:31463 (J;US)

MINES
See also COAL MINES
RUM JUNGLE PROJECT
URANIUM MINES

Aquifers
Application of stable isotopes to hydrogeology in coal mine, 14:32063 (RA;XA)

MINKOWSKI SPACE
Mapping
Mapping in inertial frames, 14:32837 (R;US)

MIRRORS
See also LASER MIRRORS

Performance
Understanding the performance of x-ray mirrors, 14:31588 (R;US)

MISGURNUS
See FISHES

MIXED CARBIDE FUELS
Dissolution
Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid, 14:30447 (J;US)

Plutonium Carbides
Alternative fuels for the French fast breeder reactors programme, 14:30848 (R;FR)

Uranium Carbides
Alternative fuels for the French fast breeder reactors programme, 14:30848 (R;FR)

MIXED OXIDE FUELS
Plutonium Oxides
Manufacture of the first fuel charge for the SUPER-PHENIX 1 reactor, 14:30847 (R;FR)

Research Programs
Mixed oxide fuel development, 14:30850 (R;US)

MIXED-FUNCTION OXIDASE SYSTEMS
See MIXED-FUNCTION OXIDASES

MIXED-FUNCTION OXIDASES
Biological Evolution
Porphyrin iron(III) mixed function oxidases: an evolutionary endpoint for transition metal(III) reactions with oxygen donors, 14:32134 (BA;US)

MIXTURES
See also BINARY MIXTURES
SLURRIES
SOLUTIONS

Chemical Reaction Yield
Analysis of elements produced in TCDDC system by mass spectrometry, 14:31387 (RA;BR;In Portuguese)

Detonations
Shock initiation modeling of multicomponent explosives, 14:31893 (R;US)

MM-0011
See NICKEL BASE ALLOYS

MODELS (ATOMIC)
See ATOMIC MODELS

MODELS (COSMOLOGICAL)
See COSMOLOGICAL MODELS

MODELS (MATHEMATICAL)
See MATHEMATICAL MODELS

MODELS (STATISTICAL)
See STATISTICAL MODELS

MODELS (STRUCTURAL)
See STRUCTURAL MODELS

MODES (OSCILLATION)
See OSCILLATION MODES

MODIFIED IN-SITU PROCESSES
Technology Assessment
Modified-in-situ technology combined with aboveground retorting and circulating fluid bed combustors could offer a viable method to unlock oil shale reserves in the near future, 14:30360 (RA;CN)
MOISTURE GAGES
Corrections
Correcting the error in neutron moisture probe measurements caused by a water density gradient, 14:31990 (R;AU)
MOLECULAR BIOLOGY
Molecular dynamics: applications to proteins, 14:32115 (BA;US)
Mathematical Models
Quantum mechanics and molecular computing: mutual implications, 14:32195 (BA;US)
MOLECULAR ORBITAL METHOD
Analytical evaluation of multicenter molecular integrals over Slater-type orbitals using expanded Loewdin alpha functions, 14:32483 (R;US)
MOLECULAR ORBITAL MODEL
See ATOMIC MODELS
MOLECULES
MOLECULAR SIEVE PROCESS
Tritium emissions reduction facility, 14:32935 (J;US)
Measuring Instruments
The use of diffuse reflectance infrared spectroscopy for studies of molecular sieve catalysis, 14:31415 (J;US)
MOLECULAR SIEVES
Performance Testing
The use of diffuse reflectance infrared spectroscopy for studies of molecular sieve catalysis, 14:31415 (J;US)
Radiation Hazards
System design for disposal of tritium at TFTR, 14:32946 (J;US)
MOLECULAR STRUCTURE
See also AMINO ACID SEQUENCE
Forecasting
Improved parameters for prediction of RNA structure, 14:32092 (BA;US)
MOLECULE COLLISIONS
See also ELECTRON-MOLECULE COLLISIONS
ION-MOLECULE COLLISIONS
MOLECULE-MOLECULE COLLISIONS
Bibliographies
International bulletin on atomic and molecular data for fusion. No. 38, 14:32873 (R;XA)
MOLECULE-MOLECULE COLLISIONS
Excitation
Excitation-transfer collisions in cesium vapor: CS(5d (5/2)) + CS(6s (1/2)) yields CS(5d (3/2)) + CS(6s (1/2)), 14:32481 (R;US)
MOLECULES
Dynamics
High-temperature behavior of grain boundaries from embedded atom method molecular dynamics simulation, 14:31188 (R;US)
Hydration
Continuum electrostatics and hydration phenomena, 14:32186 (BA;US)
Laser Spectroscopy
Pulsed molecular-beam, diode-laser spectrometry using rapid scanning techniques, 14:31886 (J;US)
Phase Studies
Classical and quantum pictures of reaction dynamics in condensed matter: resonances, dephasing, and all that, 14:31535 (J;US)
Separation Processes
Use of high-gradient magnetic fields for the separation of macromolecules, 14:31424 (J;US)
Size
Theoretical studies of the energetics and structures of atomic clusters, 14:31485 (J;US)
Symmetry
Theoretical studies of the energetics and structures of atomic clusters, 14:31485 (J;US)
MOLLUSCS
Multi-Element Analysis
Sequential determination of biological and pollutant elements in marine bivalves, 14:31460 (J;US)
MOLTEN CARBONATE FUEL CELLS
Cost
Systems analyses for high-temperature fuel cells, 14:31049 (BA;US)
Performance Testing
Systems analyses for high-temperature fuel cells, 14:31049 (BA;US)
Systems Analysis
Systems analyses for high-temperature fuel cells, 14:31049 (BA;US)
MOLYBDATES
Crystal Structure
Crystal structure of aluminum molybdate, $Al_2(MoO_4)_3$, determined by time-of-flight powder neutron diffraction, 14:31295 (J;US)
MOLYBDENUM
Catalytic Effects
Bench-scale co-processing: Quarterly report No. 2, July 1, 1988–September 30, 1988, 14:30261 (R;US)
Chemical Reactions
Reactions of ethanethiol on Mo(110): formation and decomposition of a surface alkyl thiolate, 14:31514 (J;US)
Environment
Bibliographic study on molybdenum biokinetics, 14:32396 (R;DE;In German)
Metabolism
Bibliographic study on molybdenum biokinetics, 14:32396 (R;DE;In German)
Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)
MOLYBDENUM 100 TARGET
Proton Reactions
Isobaric yield curves at *A*=72 from the spallation of medium mass isotopes by intermediate energy protons, 14:32671 (J;US)
MOLYBDENUM 92 TARGET
Isobaric yield curves at *A*=72 from the spallation of medium mass isotopes by intermediate energy protons, 14:32671 (J;US)
MOLYBDENUM 96 TARGET
Isobaric yield curves at *A*=72 from the spallation of medium mass isotopes by intermediate energy protons, 14:32671 (J;US)
MOLYBDENUM 99
Radionuclide Kinetics
Bibliographic study on molybdenum biokinetics, 14:32396 (R;DE;In German)
MOLYBDENUM ALLOYS
Grain Refinement
Effects of multiple reductions on grain refinement during hot working of alloy 718, 14:31225 (R;US)
Physical Radiation Effects
Cascade effects in non equilibrium phase transitions with metallurgical relevance (Ni/sub 4/Mo irradiation), 14:31181 (R;FR)
MOLYBDENUM SELENIDES
Chemical Preparation
Synthesis and properties of novel cluster phases: Progress report ending June 30, 1989, 14:31471 (R;US)
MOLYBDENUM SULFIDES
Oxidation
Oxidation of MoS_2 by thermal and hyperthermal atomic oxygen, 14:31331 (R;US)
MOMENTUM (LINEAR)
See LINEAR MOMENTUM
MONEL 400
Defects
Metallurgical evaluation of FMPC Vessel No. 2, 14:30426 (R;US)
MONGRELS
See DOGS
MONILIA
See CANDIDA

MONITORING (BEAM)
See BEAM MONITORING
MONITORING (RADIATION)
See RADIATION MONITORING
MONITORS (AIR POLLUTION)
See AIR POLLUTION MONITORS
MONITORS (BEAM)
See BEAM MONITORS
MONITORS (RADIATION)
See RADIATION MONITORS
MONOCLONAL ANTIBODIES
Biosynthesis
Visualization and stoichiometry of the active-enzyme cellulase complex from Trichoderma reesei, 14:30719 (RA;US)
MONTE CARLO METHOD
Three-Dimensional Calculations
3-D Montecarlo analysis of the NET shielding system, 14:32909 (RA;IT)
MOON
Characterization of lunar ilmenite resources, 14:32431 (R;US)
MOROCCO
Research Programs
Oil shale activities in Morocco, 14:30326 (RA;CN)
MORTALITY
Risk Assessment
Models for pulmonary lethality and morbidity after irradiation from internal and external sources, 14:30909 (R;US)
MORTARS
Radiolysis
Gas generation from the irradiation of mortar, 14:30524 (R;US)
MOSFET
Electric Conductivity
Modelling of MOSFET inversion layer conductivity using the resistor network method, 14:31861 (R;GB)
Physical Radiation Effects
Modelling of MOSFET inversion layer conductivity using the resistor network method, 14:31861 (R;GB)
MOUND LABORATORY
Efficiency
Improvements in efficiency, capacity, and reliability of Mound's effluent removal system, 14:32951 (J;US)
Molecular Sieve Process
Tritium emissions reduction facility, 14:32935 (J;US)
MULTI-NUCLEON TRANSFER REACTIONS
Interaction cross sections for multinucleonic processes in light nuclear systems, 14:32719 (R;RO;In Romanian)
MULTIGROUP THEORY
Benchmarks
Implantation of multigroup diffusion code 2DB in the IEAv CDC CYBER 170/750 system, and its preliminary evaluation, 14:30861 (R;BR;In Portuguese)
Cdc Computers
Implantation of multigroup diffusion code 2DB in the IEAv CDC CYBER 170/750 system, and its preliminary evaluation, 14:30861 (R;BR;In Portuguese)
MULTIPARTICLE SPECTROMETERS
Data Acquisition Systems
MPS [Multiparticle Spectrometer] data acquisition software system, 14:31804 (R;US)
MULTIPHASE FLOW
Measuring Methods
Two-phase flow measurements by nuclear magnetic resonance imaging, 14:31657 (R;US)
MULTIPROCESSING
See PARALLEL PROCESSING
MULTIPROCESSORS
See ARRAY PROCESSORS
MULTISPHERE NEUTRON DETECTORS
See BONNER SPHERE DETECTORS
MULTIWIRE DRIFT CHAMBERS
See DRIFT CHAMBERS
MULTIWIRE PROPORTIONAL CHAMBERS
See also DRIFT CHAMBERS
Design
MWPC with highly segmented cathode pad readout, 14:31803 (R;US)
MUNICIPAL BUILDINGS
See PUBLIC BUILDINGS
MUNICIPAL WASTES
Incinerators
Evaluation of HCl continuous-emission monitors. Final report, May 1986-May 1987, 14:31949 (R;US)
Pollutants
Analytical procedures for environmental quality control. Volume 2. Technical report, 14:32042 (R;US)
Waste Management
The provincial role in municipal solid waste management. A discussion paper, 14:31134 (R;CA)
Waste Processing
Evaluation of rotary-drum air classification of shredded and unshredded municipal solid waste. Final report, 14:31149 (R;US)
Waste Water
Analytical procedures for environmental quality control. Volume 3. Technical report, 14:32043 (R;US)
MUON DETECTION
Streamer Spark Chambers
Tracking techniques in underground physics, 14:31813 (R;IT)
MUONIUM
Conversion
Constraints on muonium-antimuonium conversion, 14:32605 (J;US)
Particle Production
Formation of the negative muonium ion and charge-exchange processes for positive muons passing through thin metal foils, 14:32526 (J;US)
Production
Observation of the negative muonium ion in vacuum, 14:32505 (R;US)
MUONS
See also MUONS PLUS
Particle Decay
Pion and muon decays beyond the standard model, 14:32589 (R;US)
MUONS PLUS
Electron Capture
Formation of the negative muonium ion and charge-exchange processes for positive muons passing through thin metal foils, 14:32526 (J;US)
MUSCLES
See also MYOCARDIUM
Computerized Tomography
Diagnosis of skeleton and soft tissues by CT and MRT, 14:32309 (RA;DD;In German)
Hereditary myopathies in patients free of signs as evidenced by CT, 14:32308 (RA;DD;In German)
Hereditary Diseases
Hereditary myopathies in patients free of signs as evidenced by CT, 14:32308 (RA;DD;In German)
Nmr Imaging
Diagnosis of skeleton and soft tissues by CT and MRT, 14:32309 (RA;DD;In German)
Diagnostic value of NMR imaging in myopathies, 14:32248 (RA;DD;In German)
Pathological Changes
Diagnostic value of NMR imaging in myopathies, 14:32248 (RA;DD;In German)
MUSCULAR TISSUE
See MUSCLES
TISSUES
MUTAGENIC PATHWAYS
See BIOLOGICAL PATHWAYS
MUTATION FREQUENCY
Mathematical Models
Male-driven molecular evolution: a model and nucleotide sequence analysis, 14:32164 (BA;US)
MUTATION INDUCTION PATHWAYS
See BIOLOGICAL PATHWAYS

MUTATIONS
See also CHROMOSOMAL ABERRATIONS
Radioinduction
Molecular characterization of x-ray induced mutations at the HGPRT locus in plateau phase Chinese hamster ovary cells: Effect of dose, dose fractionation, and delayed plating, 14:32393 (R;US)
MWPC
See MULTIWIRE PROPORTIONAL CHAMBERS
MYOCARDIUM
Nmr Spectra
Studies of cardiac protection by anti-ischemic and cytoprotective drugs, resp., using /sup 31/P-NMR spectroscopy, 14:32267 (RA;DD;In German)
MYOGLOBIN
Electron Transfer
Influence of geometrical fluctuations on electron tunneling barriers in proteins, 14:32179 (BA;US)

N

N CODES
Comparative Evaluations
Comments on MC/sup 2/-2 and MINX computer codes, 14:32990 (R;BR;In Portuguese)
Cross Sections
Comments on MC/sup 2/-2 and MINX computer codes, 14:32990 (R;BR;In Portuguese)
Integral Cross Sections
Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections, 14:32995 (R;BR;In Portuguese)
Multigroup Theory
Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections, 14:32995 (R;BR;In Portuguese)
Resonance
Evaluation of ETOG-3Q, ETOG-3, FLANGE-II, XLACS, NJOY and LINEAR/RECENT/GROUPIE computer codes concerning to the resonance contribution and background cross sections, 14:32995 (R;BR;In Portuguese)
NAD
Stereochemistry
Determination of the absolute configuration of (-)-(2R)-succinic-2-d acid by neutron diffraction study: Unambiguous proof of the absolute stereochemistry of the NAD+/NADH interconversion, 14:32355 (J;US)
NAI DETECTORS
Calibration
Measurements and calculations on the responses of a NaI(Tl) detector immersed in a water tank containing different radioisotopes, 14:31832 (RA;AT)
NAPAP
Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985, 14:30799 (R;US)
Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988, 14:30800 (R;US)
Bibliographies
National Acid Precipitation Assessment Program (NAPAP): pollutant emission inventories available on tape inventories. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31965 (R;US)
NAPHTHA
Indoor Air Pollution
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Production
New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)
NAPHTHALENE
Hydrogen Transfer
Long-lived quinone-naphthalene triplet excited complexes: direct measure of rates of proton transfer within intimate radical ion pairs, 14:31566 (J;US)
NASOPHARYNX
See PHARYNX
NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM
See NAPAP
NATIONAL DEFENSE
See also BALLISTIC MISSILE DEFENSE
Feasibility Studies
Goals for limited strategic defenses, 14:31899 (R;US)
Mathematical Models
Issues in the sequential deployment of strategic defenses, 14:31900 (R;US)
Simplified anti-submarine warfare problem treated as a steady state Markov process, 14:33015 (J;US)
NATIONAL GOVERNMENT
Allocations
State uses of Exxon and Stripper Well oil overcharge funds: Status report No. 3, 14:30306 (R;US)
NATIONAL REACTOR TESTING STATION
See IDAHO NATIONAL ENGINEERING LABORATORY
NATURAL ACTIVITY
See NATURAL RADIOACTIVITY
NATURAL GAS
Development and field test of a desiccant-based air conditioning system for supermarkets. Final report, October 1983-May 1988, 14:31073 (R;US)
Compressed Gases
Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report, 14:31164 (R;US)
Economics
Financial aspects of the consolidation of the US oil and gas industry in the 1980's, 14:30300 (R;US)
Gas Fuels
Development of fast-burn combustion with elevated coolant temperatures for natural gas engines. Annual report, May 1987-April 1988, 14:31165 (R;US)
Market
Natural gas market assessment, 14:30319 (R;CA)
Origin
Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)
Performance
Evaluation of compressed natural gas conversion systems, 14:31166 (R;CA)
Pipelines
Development of a magnetic coating for gas pipe detection. Final report, May 1987-June 1988, 14:30322 (R;US)
Spark Ignition Engines
Development of fast-burn combustion with elevated coolant temperatures for natural gas engines. Annual report, May 1987-April 1988, 14:31165 (R;US)
Supply and Demand
Canadian energy supply and demand, 1987-2005. Summary, 14:30997 (R;CA;In French)
Natural gas market assessment, 14:30319 (R;CA)
NATURAL GAS DEPOSITS
Numerical Data
Alberta gas reserve trends, 14:30315 (R;CA)
Production
Development of gas-bearing reservoirs in the Trenton Llimestone Formation of New York. Final report, 14:30316 (R;US)
NATURAL GAS DISTRIBUTION SYSTEMS
Environmental Effects
Environmental aspects of rights-of-way for natural gas transmission pipelines: An updated bibliography: Final report, September 1987–June 1988, 14:30321 (R;US)

NATURAL GAS FUEL CELLS
Performance
Electrochemical oxidation of methane at metal and oxide electrodes. Annual report, December 1, 1987-December 1, 1988, 14:31046 (R;US)

NATURAL GAS GATHERING SYSTEMS
See NATURAL GAS DISTRIBUTION SYSTEMS

NATURAL GAS LIQUIDS
Supply and Demand
Canadian energy supply and demand, 1987-2005. Summary, 14:30997 (R;CA;In French)

NATURAL GAS WELLS
Pipes
The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel, 14:31236 (BA;US)

NATURAL GASOLINE
See NATURAL GAS LIQUIDS

NATURAL RADIOACTIVITY
Radiation Doses
Investigations on natural radiation burden in Austria, 14:31985 (RA;AT;In German)
Thorium
Study of the effect of natural radiation damage in crystal using thermoluminescence fission track etching and x-ray diffraction, 14:31322 (RA;BR)
Uranium
Study of the effect of natural radiation damage in crystal using thermoluminescence fission track etching and x-ray diffraction, 14:31322 (RA;BR)
Zircon
Study of the effect of natural radiation damage in crystal using thermoluminescence fission track etching and x-ray diffraction, 14:31322 (RA;BR)

NATURAL URANIUM
Photofission
Photofission assay of 500 litre drums of cemented intermediate level waste. Experimental measurements, 14:31382 (R;GB)

NAVIER-STOKES EQUATION
See NAVIER-STOKES EQUATIONS

NAVIER-STOKES EQUATIONS
Numerical Solution
A second-order projection method for the incompressible Navier Stokes equations on quadrilateral grids, 14:32529 (R;US)

NEBULAE
See also CRAB NEBULA
Gamma Detection
The application of two-dimensional imaging to very high energy gamma ray astronomy: Progress report, 14:32444 (R;US)

NECK
Neoplasms
Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)

NEGATIVE IONS
See ANIONS

NEGATONS
See ELECTRONS

NEGATRONS
See ELECTRONS

NEODYMIUM
Ion Exchange Chromatography
Rapid determination of burn-up of nuclear fuel - a possible approach, 14:31447 (J;US)
Liquid Column Chromatography
Rapid determination of burn-up of nuclear fuel - a possible approach, 14:31447 (J;US)

NEODYMIUM 146
Alpha Decay
Application of the Reich-Moore formalism to description of interresonance interference in the α-decay channel of /sup 68/Zn and /sup 146/Nd compound nuclei, 14:32731 (RA;SU;In Russian)

NEODYMIUM LASERS
Beam Dynamics
Observation of parametric gain suppression in stimulated rotational Raman scattering over long air paths, 14:32887 (BA;US)
Beam Optics
Observation of anomalous low J-value Stokes and anti-Stokes lines in stimulated rotational Raman scattering over long air paths, 14:31645 (BA;US)
Polarization
Polarization effects in diode-laser-pumped Nd, 14:31640 (BA;US)

NEON
Phase Studies
X-ray diffraction and equation of state of solid neon to 110 GPa, 14:31370 (J;US)

NEOPLASMS
See also ADENOMAS
CARCINOMAS
GLIOMAS
LEUKEMIA
LYMPHOMAS
SARCOMAS
Diagnosis
Echography in diagnosis of breast cancer, 14:32215 (RA;BR;In Portuguese)
Proceedings of the 2. Iberian-American Congress of Oncology, 14:32212 (R;BR;In Portuguese)
Epidemiology
Epidemiological studies relating human health to electric and magnetic fields. Criteria for evaluation, 14:32408 (R;CA)
Mammary Glands
Echography in diagnosis of breast cancer, 14:32215 (RA;BR;In Portuguese)
Primary radiotherapy x mastectomy in operable cancrum of breast, 14:32219 (RA;BR;In Portuguese)
Meetings
Proceedings of the 2. Iberian-American Congress of Oncology, 14:32212 (R;BR;In Portuguese)
Neutron Therapy
Clinical dosimetry at remote neutron therapy irradiation in Kiev U-120 cyclotron, 14:32762 (RA;SU;In Russian)
Nmr Spectra
/sup 1/H-NMR spectroscopy - a new method in tumor diagnosis?, 14:32261 (RA;DD;In German)
Radioinduction
ASA conference on radiation and health: Coolfont 7: Final report, 14:32370 (R;US)
DOE contractors' meeting on chemicals with living systems, 14:32395 (R;US)
Radiotherapy
Cancer of endometrium, stage I. Treatment and results, 14:32220 (RA;BR;In Spanish)
Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)
Risk Assessment
Assessment of the consequences of a research reactor credible accident release, 14:30913 (RA;AT)
Validity and reliability of results of epidemiological studies for the estimation of the radiation included lung cancer risk, 14:32380 (RA;AT)
Therapy
Proceedings of the 2. Iberian-American Congress of Oncology, 14:32212 (R;BR;In Portuguese)
Uterus
Cancer of endometrium, stage I. Treatment and results, 14:32220 (RA;BR;In Spanish)

NEPHRITIS
Computerized Tomography
Some peculiar facts of the CT diagnosis of xanthogranulomatous pyelonephritis, 14:32291 (RA;DD)

NEPTUNIUM 237
Quantitative Chemical Analysis
Determination of neptunium by controlled-potential coulometry, 14:30441 (R;US)

NEPTUNIUM FLUORIDES
Binding Energy
4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
NEPTUNIUM ISOTOPES
See also NEPTUNIUM 237
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
NEPTUNIUM OXIDES
Binding Energy
4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
NET TOKAMAK
Fabrication
First wall for NET. Engineering studies, mock up design and manufacturing, 14:32913 (RA;IT)
First Wall
First wall for NET. Engineering studies, mock up design and manufacturing, 14:32913 (RA;IT)
Shielding
3-D Montecarlo analysis of the NET shielding system, 14:32909 (RA;IT)
Superconducting Magnets
Contributions to the 12th. International Cryogenic Engineering Conference. Southampton, 12-15 July 1988, 14:32905 (R;IT)
NETHERLANDS
Radioactive Waste Management
Location-independent study concerning the construction, operation and closure of possible facilities for the final storage of radioactive waste in rock-salt formations in the Netherlands. Executed by Van Hattum and Blankevoort asked for by the Netherlands Energy Research Foundation and subsidized by the Ministry of Economic Affairs, 14:30564 (R;NL;In Dutch)
Seasonal Thermal Energy Storage
Heating of an office building using solar energy in combination with a heat pump and seasonal heat storage, 14:30950 (RA;CA;In English and French)
The feasibility of seasonal storage of excess heat for the district heating system at Almere, 14:30954 (RA;CA;In English and French)
NETWORKS (COMPUTER)
See COMPUTER NETWORKS
NEUTRAL ATOM BEAM INJECTION
Power Losses
TFTR [Tokamak Fusion Test Reactor] neutral beam injected power measurement, 14:32928 (R;US)
NEUTRAL BEAM SOURCES
Performance
Evaluation of pulsed fast-atom bombardment ionization for increased sensitivity of tandem mass spectrometry, 14:31401 (J;US)
NEUTRINO OSCILLATION
Neutrino Detection
LAMPF E645/current status, 14:32546 (R;US)
NEUTRINO-ELECTRON INTERACTIONS
See also ANTINEUTRINO-ELECTRON INTERACTIONS
Cross Sections
Neutrino-electron scattering and the choice between different Mikheyev-Smirnov-Wolfenstein solutions of the solar neutrino problem, 14:32470 (J;US)
Elastic Scattering
Determination of $\sin^2\theta_W$ from measurements of differential cross sections for muon-neutrino and -antineutrino scattering by electrons, 14:32569 (J;US)
NEUTRINOS
See also COSMIC NEUTRINOS
SOLAR NEUTRINOS
Single-Particle Modes
Neutrino oscillations at accelerators. Past results, future prospects, 14:32836 (R;FR)
NEUTRON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
NEUTRON REACTIONS
NEUTRON BEAMS
Beam Production
Neutron beam facility at NAC, 14:32972 (R;ZA)
NEUTRON CAPTURE
See NEUTRON REACTIONS
NEUTRON DETECTORS
Design
An imaging detector for neutron or gamma sources, 14:31824 (R;US)
Wire chamber assembly techniques: More methods, 14:31823 (R;US)
Performance
Performance of prototype position-sensitive neutron detectors on SXD at ISIS, 14:31850 (R;GB)
Position Sensitive Detectors
Performance of prototype position-sensitive neutron detectors on SXD at ISIS, 14:31850 (R;GB)
NEUTRON DIFFRACTOMETERS
Glass Scintillators
Detector system for two-dimensional, position-sensitive detection of neutrons and gamma quanta, 14:31816 (R;DE;In German)
NEUTRON DOSIMETRY
Dosemeters
1987 Neutron and gamma personnel dosimeter intercomparison study using a D_2O-moderated ^{252}Cf source, 14:31848 (R;US)
Calculated dose equivalent responses of albedo and track etch individual neutron dosemeters on the ICRU-phantom, 14:31835 (RA;AT)
NEUTRON ECONOMY
See NEUTRON FLUX
NEUTRON FLUENCE
Measuring Methods
Measuring time-dependent neutron flux from 14MeV neutron generators by radioactivation techniques, 14:31846 (RA;AT;In German)
NEUTRON FLUX
Resonance
Analysis of resonance oscillation of the neutron flow in a BWR-core, 14:30823 (R;SE;In Swedish)
NEUTRON FLUX DENSITY
See NEUTRON FLUX
NEUTRON MATTER
See NUCLEAR MATTER
NEUTRON MOISTURE METERS
See MOISTURE GAGES
NEUTRON REACTIONS
See also FAST FISSION
Capture
Experimental determination of resonance self-shielding factors affecting the neutron radiative capture cross-section for /sup 238/U in the 10 to 140 keV energy range, 14:32686 (RA;XA)
Measurement of the neutron radiative capture cross-sections for /sup 236/U and /sup 197/Au in the 3-420 keV energy range, 14:32687 (RA;XA)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
Coupled Channel Theory
Description of neutron strength functions with allowance for multi-channel coupling, 14:32728 (RA;SU;In Russian)
Energy-Level Density
Spectra of inelastically scattered neutrons with an initial energy of 14.1 MeV and nuclear level density, 14:32646 (R;XA)
Feshbach-Weisskopf Model
Multistep processes in neutron-induced reactions, 14:32729 (RA;SU)

Inelastic Scattering
Methods for the calculation of neutron induced reactions, 14:32714 (R;XA)
Spectra of inelastically scattered neutrons with an initial energy of 14.1 MeV and nuclear level density, 14:32646 (R;XA)
Meetings
Neutron physics. Vol. 2, 14:32647 (R;SU;In Russian)
Optical Models
Methods for the calculation of neutron induced reactions, 14:32714 (R;XA)
Self-Shielding
Experimental determination of resonance self-shielding factors affecting the neutron radiative capture cross-section for /sup 238/U in the 10 to 140 keV energy range, 14:32686 (RA;XA)
Strength Functions
Description of neutron strength functions with allowance for multi-channel coupling, 14:32728 (RA;SU;In Russian)
T Invariance
On verification of t invariance in neutron reactions, 14:32723 (RA;SU;In Russian)

NEUTRON SOURCE FACILITIES
Neutron Fluence
Measuring time-dependent neutron flux from 14MeV neutron generators by radioactivation techniques, 14:31846 (RA;AT;In German)

NEUTRON SOURCES
Measurement and fitting of pulse shapes of moderators at IPNS [Intense Pulsed Neutron Source]: Progress report, 14:30646 (R;US)
Design
The Aspun Project, 14:31694 (R;US)
Fast Neutrons
Measurement of fast neutron spectra from iron shielded americium-beryllium source, 14:32751 (RA;AT)

NEUTRON SPECTROSCOPY
Inelastic Scattering
High energy magnetic inelastic neutron scattering at ISIS, 14:32752 (R;GB)
Magnetic Dipole Moments
High energy magnetic inelastic neutron scattering at ISIS, 14:32752 (R;GB)

NEUTRON THERAPY
Depth Dose Distributions
Clinical dosimetry at remote neutron therapy irradiation in Kiev U-120 cyclotron, 14:32762 (RA;SU;In Russian)
Dosimetry
Clinical dosimetry at remote neutron therapy irradiation in Kiev U-120 cyclotron, 14:32762 (RA;SU;In Russian)

NEUTRON TRANSPORT
Monte Carlo Method
Criticality benchmarks for COG: A new point-wise Monte Carlo code, 14:32754 (R;US)

NEUTRONS
See also EPITHERMAL NEUTRONS
FAST NEUTRONS
FISSION NEUTRONS
SLOW NEUTRONS
THERMAL NEUTRONS
Electric Dipole Moments
CP violation in the two-generation version of left-right models, 14:32614 (J;US)
Particle Production
TFTR health physics tritium measurements following D-D operations, 14:32953 (J;US)
Scattering
Anisotropy and energy dependence of the differential neutron scattering cross-section in vanadium, 14:32753 (R;GB)
Vanadium
Anisotropy and energy dependence of the differential neutron scattering cross-section in vanadium, 14:32753 (R;GB)

NEVADA
Radiation Monitoring
Community Radiation Monitoring Program annual report, October 1, 1987–September 30, 1988, 14:31982 (R;US)
Volcanic Regions
Chemical and mineralogic trends within the Timber Mountain–Oasis Valley caldera complex, Nevada: Evidence for Multiple cycles of chemical evolution in a long-lived silicic magma system, 14:32427 (J;US)
Evidence for dynamic withdrawal from a layered magma body: The Topopah Spring Tuff, southwestern Nevada, 14:32426 (J;US)
Phenocryst abundances and glass and phenocryst compositions as indicators of magmatic environments of large-volume ash flow sheets in southwestern Nevada, 14:32428 (J;US)
Volcanic centers of southwestern Nevada: Evolution of understanding, 1960–1988, 14:32425 (J;US)

NEVADA TEST SITE
A review of aerial radiological surveys of Nevada Test Site fallout fields 1951 through 1970, 14:31984 (R;US)
Data Acquisition
Sandia's UGT Instrumentation Development Program: INWET'89 Paper No. 15, 14:31876 (R;US)

NEW BRUNSWICK
Oil Shale Deposits
Geology of New Brunswick oil shales, eastern Canada, 14:30330 (RA;CN)

NEW JERSEY
Radioactive Waste Disposal
Correlation between thorium concentrations in soil and gamma readings in FUSRAP site in New Jersey, 14:32024 (J;US)

NEW YORK
Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report, 14:31164 (R;US)
District Cooling
Buffalo district heating and cooling system: technical and economic assessment. Final report, 14:31150 (R;US)
District Heating
Buffalo district heating and cooling system: technical and economic assessment. Final report, 14:31150 (R;US)
Rochester district-heating-system reconfiguration: technical and economic feasibility. Final report, 14:31151 (R;US)
Fossil-Fuel Power Plants
Technical/economic impacts and implications of using washed coals at New York State utilities. Final report, 14:30798 (R;US)
Natural Gas Deposits
Development of gas-bearing reservoirs in the Trenton Llimestone Formation of New York. Final report, 14:30316 (R;US)
Small-Scale Hydroelectric Power Plants
Report on modular hydropower demonstration, 14:30677 (R;US)

NEWFOUNDLAND
Peat
Fuel peat in Newfoundland, 14:30280 (R;CA)

NEWTS
See SALAMANDERS

NEXT EUROPEAN TORUS
See NET TOKAMAK

NGL
See NATURAL GAS LIQUIDS

NICKEL
Catalytic Effects
Study of ammonia removal in coal gasification processes: Final report, 14:30249 (R;US)
Chemical Reactions
Kinetics of the complexation of nickel (II) with 8-hydroxyquinoline in aqueous solution, 14:31488 (J;US)
Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)
Separation Processes
Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)
Sorptive Properties
Generation and detection of a monolayer grating by laser desorption and second-harmonic generation: CO on Ni(111), 14:32805 (J;US)

Surface Properties
Comparative study of angle-resolved valence-band photoemission from half-monolayer structures of C, N, and O on Ni(100), 14:31259 (J;US)
Total Cross Sections
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
X Radiation
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)

NICKEL 58 TARGET
Alpha Reactions
Influence of Coulomb field of the third particle on a decay of two-fragment nuclear resonances, 14:32656 (R;SU;In Russian)
Collective Excitations
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Deep Inelastic Heavy Ion Reactions
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Inclusive Interactions
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Quasi-Elastic Scattering
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Silicon 28 Reactions
Contribution of nucleon transfer to the elastic scattering of $^{28}Si+^{58,64}Ni$ near the Coulomb barrier, 14:32667 (J;US)

NICKEL 64 TARGET
Lanthanum 139 Reactions
The end of incomplete fusion and the decoupling of the fireball as seen from complex fragment emission, 14:32670 (R;US)
Silicon 28 Reactions
Contribution of nucleon transfer to the elastic scattering of $^{28}Si+^{58,64}Ni$ near the Coulomb barrier, 14:32667 (J;US)

NICKEL ALLOYS
See also NICKEL BASE ALLOYS
Catalytic Effects
Development of ternary alloy cathode catalysts for phosphoric acid fuel cells: Final report, 14:31043 (R;US)
Corrosion
Degradation of Fe-25Cr, Fe-25Cr-20Ni and Fe-25Cr-6A1 alloys in $H_2/H_2O/H_2S$ environments at 700°C, 14:31221 (R;US)
Electrical Properties
Microscopic real-space approach to the theory of metallic glasses, 14:31248 (J;US)
Electrochemistry
An XPS study of the passivity of an amorphous Co-20P alloy, 14:31292 (BA;US)
Electronic Structure
Surface states on NiAl(110), 14:31262 (J;US)
Passivation
An XPS study of the passivity of an amorphous Co-20P alloy, 14:31292 (BA;US)
Plasticity
Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking, 14:31216 (R;US)
Solidification
The solidification metallurgy of Alloy 718 and other Nb-containing superalloys, 14:31227 (R;US)
Solution Heat
Alloy models with the embedded-atom method, 14:31257 (J;US)

NICKEL BASE ALLOYS
See also MONEL 400
Grain Boundaries
Experimental studies of the structure of grain boundaries: Progress report, 14:31191 (R;US)
The structure and properties of grain boundaries in B2 ordered alloys: Progress report, 14:31193 (R;US)
Grain Refinement
Effects of multiple reductions on grain refinement during hot working of alloy 718, 14:31225 (R;US)
Microstructure
The hot deformation behavior of an as-cast alloy 718 ingot, 14:31226 (R;US)
Physical Radiation Effects
Cascade effects in non equilibrium phase transitions with metallurgical relevance (Ni/sub 4/Mo irradiation), 14:31181 (R;FR)
Stress Corrosion
Proceedings: 1986 workshop on advanced high-strength materials, 14:30821 (R;US)

NICKEL COMPLEXES
Chemical Preparation
Kinetics of the complexation of nickel (II) with 8-hydroxyquinoline in aqueous solution, 14:31488 (J;US)

NICKEL COMPOUNDS
See also NICKEL OXIDES
NICKEL PHOSPHIDES
Structural Chemical Analysis
Crystal and molecular structure of a nickel isobacteriochlorin derived from a chlorophyll, 14:32185 (BA;US)
High-pressure spectroscopic studies of ferrocene, nickelocene, and ruthenocene, 14:31503 (J;US)
Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene, 14:31504 (J;US)

NICKEL OXIDES
Interfaces
High-resolution electron microscopy of metal/ceramic interfaces, 14:31186 (R;US)

NICKEL PHOSPHIDES
Chemical Vapor Deposition
The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel, 14:31236 (BA;US)

NICKEL-IRON BATTERIES
See IRON-NICKEL BATTERIES

NICOTINAMIDE-ADENINE DINUCLEOTIDE
See NAD

NIGHTGLOW
See AIRGLOW

NIOBIUM
Crystal Structure
Discrete and continuous disorder in superlattices, 14:31263 (J;US)
Deformation
Deformation and failure mechanisms of niobium and tantalum during tensile testing in uranium at 1473 K, 14:31240 (J;US)
Effect of strain rate on the electroplastic effect in Nb, 14:31176 (R;US)
Optical Properties
Interpretation of the optical properties of Nb, 14:31261 (J;US)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
Sorptive Properties
Adsorbed layer and multilayer materials: The energetics and bonding of Pd and Ag on Nb(001) and Nb(110), 14:31258 (J;US)
Strain Rate
Effect of strain rate on the electroplastic effect in Nb, 14:31176 (R;US)

NIOBIUM 93 TARGET
Collective Excitations
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Deep Inelastic Heavy Ion Reactions
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Inclusive Interactions
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)
Quasi-Elastic Scattering
Study of excitation energy sharing in heavy ion collisions as a function of their inelasticity, 14:32663 (R;FR;In French)

NIOBIUM ALLOYS
Microstructure
The hot deformation behavior of an as-cast alloy 718 ingot, 14:31226 (R;US)
Solidification
The solidification metallurgy of Alloy 718 and other Nb-containing superalloys, 14:31227 (R;US)
NIOBIUM COMPOUNDS
See also NIOBIUM IODIDES
NIOBIUM NITRIDES
Chemical Preparation
Synthesis and properties of novel cluster phases: Progress report ending June 30, 1989, 14:31471 (R;US)
NIOBIUM IODIDES
Synthesis and properties of novel cluster phases: Progress report ending June 30, 1989, 14:31471 (R;US)
NIOBIUM NITRIDES
Oxidation
Raman spectroscopic observation of laser-induced oxidation of transition-metal borides, carbides, and nitrides, 14:31294 (J;US)
NITRATES
See also PEROXYACETYL NITRATE
PLUTONIUM NITRATES
SODIUM NITRATES
URANIUM NITRATES
Atmospheric Precipitations
Contribution of atmospheric nitrate deposition to nitrate loading in the Chesapeake Bay. Final report, 14:32045 (R;US)
Catalytic Effects
Mini-melter studies of high level nuclear waste form development: effects of added nitrates, carbonates and nitrates/formates in the slurry feed, 14:30506 (RA;US)
Gas Chromatography
Capillary gas chromatographic separation of alkyl nitrates and peroxycarboxylic nitric anhydrides, 14:31411 (J;US)
NITRIC ACID
Phase Studies
Effect of uranium on third phase formation in the Pu(IV)-HNO_3-TBP-dodecane system, 14:30445 (J;US)
Solvent Extraction
Mathematical modelling of extraction dynamics in differential-contact extractor, 14:31576 (R;SU;In Russian)
Thermodynamic modeling of chemical equilibria in metal extraction, 14:31420 (J;US)
Solvent Properties
Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid, 14:30447 (J;US)
NITRILES
See also ACRYLONITRILE
Denitration
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
NITRO COMPOUNDS
See also NITROMETHANE
TNT
Fragmentation
Characterization of booster-rocket propellants and their simulants, 14:31895 (R;US)
Synthesis
Nitration of acephenanthrylene under simulated atmospheric conditions in solution and the presence of nitroacephenanthrylene(s) in ambient particles, 14:31979 (J;US)
NITROGEN
Chemisorption
Comparative study of angle-resolved valence-band photoemission from half-monolayer structures of C, N, and O on Ni(100), 14:31259 (J;US)
Electron Collisions
Inclusion of electron correlation for the target wave function in low- to intermediate-energy e-N_2 scattering, 14:32482 (R;US)
Electron-Molecule Collisions
Subexcitation electrons in gas phase, 14:32489 (R;US)
Energy-Level Transitions
Rotationally inelastic scattering of N_2 from clean and hydrogen covered Pd(111), 14:32807 (J;US)
Removal
Preliminary study on hydrotreating of a high sulfur content shale oil, 14:30361 (RA;CN)
Separation Processes
Study of nonsteady-state continuous membrane column for gas separation, 14:31438 (J;US)
Sorption
Effects of particle shape and size distribution on sorption and flow performance in electrically stabilized expanded beds, 14:31449 (J;US)
NITROGEN 14
Isotope Separation
Separation of nitrogen isotopes by displacement band chromatography, 14:31491 (J;US)
NITROGEN 15
Separation of nitrogen isotopes by displacement band chromatography, 14:31491 (J;US)
NITROGEN COMPOUNDS
See also HYDRAZINE
ISOCYANIC ACID
NITRATES
NITROGEN HYDRIDES
NITROGEN OXIDES
Biosynthesis
Studies on the biosynthesis of the m-C_7N unit in the antibiotics manumycin and asukamycin, 14:31507 (J;US)
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
Removal
Concentration and removal of nitrogen and sulfur containing compounds from organic liquids phases using electrochemically reversed chemical complexation, 14:30268 (J;US)
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
Thermodynamic Properties
Vapor-liquid equilibria in fluids of two-center Lennard-Jones molecules, 14:31546 (J;US)
NITROGEN HYDRIDES
See also AMMONIA
Absorption Spectra
Algebraic approach to molecular electronic spectra. I. Energy levels, 14:32509 (J;US)
NITROGEN NITRIDES
See NITROGEN
NITROGEN OXIDES
See also NITROUS OXIDE
Ecological Concentration
Dutch priority programme on acidification: Summary report, Acidification research, 1984–1988, 14:31969 (R;NL)
Mathematical Models
Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985, 14:30799 (R;US)
Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988, 14:30800 (R;US)
Pollution Control
Combined SO_2/NO_x control technologies, 14:30271 (R;US)
Removal
Environmental Research Program: FY 1988 annual report, 14:31931 (R;US)
Environmental research program: FY 1987, annual report, 14:31929 (R;US)
Study of ammonia removal in coal gasification processes: Final report, 14:30249 (R;US)
NITROMETHANE
Chemical Reactions
Production of the nitromethane aci ion by static high pressure, 14:31539 (J;US)

NITROSAMINES
Biological Effects
Biological (molecular and cellular) markers of toxicity: Semi-annual technical progress report (No.1), October 1, 1988–March 31, 1989, 14:32399 (R;US)
Occupational Exposure
Hydrazine: usage and exposure in the electric power industry, 14:30808 (R;US)

NITROUS ACID
Decomposition
Depletion of aqueous nitrous acid in packed towers, 14:31425 (J;US)

NITROUS ACID ESTERS
Pyrolysis
Thermal decomposition of methyl nitrite: kinetic modeling of detailed product measurements by gas-liquid chromatography and Fourier transform infrared spectroscopy, 14:31585 (J;US)

NITROUS OXIDE
Measuring Methods
N_2O field study. Final report, 14:30810 (R;US)

NITROXYL RADICALS
Chemical Reaction Kinetics
Kinetics of the reaction of NO_3 with HO_2, 14:31512 (J;US)

NMR
See NUCLEAR MAGNETIC RESONANCE

NMR IMAGING
Contrast Media
Dynamic MRI of transplanted kidneys after application of Gd-DTPA, 14:32276 (RA;DD)
Gd-DTPA - a positive oral contrast medium in abdominal MR tomography, 14:32234 (RA;DD;In German)
Gd-DTPA in hypophyseal microadenoma diagnosis, 14:32275 (RA;DD;In German)
MRI contrast agents, 14:32273 (RA;DD)
Image Processing
NMR imaging of the knee-joint cartilage using 3D volume imaging combined with a fast computer for image processing, 14:32316 (RA;DD;In German)
Procedure of the three-dimensional representation of tomographic image arrays, 14:32320 (RA;DD;In German)
Nmr Spectra
Integrated MRI/MRS, 14:32259 (RA;DD)
Optimization
Fast-scan magnetic resonance imaging, 14:32228 (RA;DD)
Optimization of pulse sequence and parameters in NMR imaging to improve the contrast-to-noise ratio by non-linear optimization, 14:32262 (RA;DD;In German)
Quality Assurance
Test of NMR image quality affecting parameters, 14:32231 (RA;DD)
Relaxation Time
Medical applications of field cycling relaxometry, 14:32229 (RA;DD)
Socio-Economic Factors
Role of the MRI in medical imaging - socio-economical analyses, 14:32250 (RA;DD)
Spectroscopy
Methodology and first clinical application of localized proton spectroscopy in cases of brain tumors and ischemic insults, 14:32264 (RA;DD;In German)
Weighting Functions
Theoretical evaluation and experimental results of parameter weighting in NMR imaging, 14:32230 (RA;DD)

NMR SPECTRA
Magnetite
Effect of substances shortening the relaxation time on /sup 31/P and /sup 13/C-NMR spectroscopy, 14:32269 (RA;DD;In German)

NOBLE GASES
See RARE GASES

NON-PROLIFERATION POLICY
Political Aspects
International Atomic Energy Aagency safeguards: observations on lessons for verifying a chemical weapons convention, 14:31171 (R;CA)

NONLINEAR PROBLEMS
Heating Systems
Deterministic chaos in energy-technichological systems, 14:31142 (R;DK;In Danish)
Perturbation Theory
A new perturbative approach to nonlinear problems, 14:32848 (J;US)

NONLINEAR SYSTEMS
See NONLINEAR PROBLEMS

NONRADIOACTIVE WASTE DISPOSAL
See WASTE DISPOSAL

NORTH DAKOTA
Military Facilities
Installation-Restoration Program. Phase 2. Confirmation/quantification stage 1 for Minot Air Force Base, Minot, North Dakota. Volume 2. Appendices A through F. Final report, September 1985-October 1988, 14:32032 (R;US)

NORTH SEA
Reservoir Fluids
Procedures for reservoir fluid characterization using an equation of state model. Application to fluids in the Danish North Sea, 14:30393 (R;DK)

NORTHERN IRELAND
See UNITED KINGDOM

NORTHWEST TERRITORIES
Phytoplankton
Phytoplankton primary production and related limnological data for lakes and channels in the Mackenzie Delta and lakes on the Tuktoyaktuk Peninsula, N.W.T., 14:32028 (R;CA)

NOVA SCOTIA
Recycling
The Minister's Task Force on Litter Abatement. Report, 14:31148 (R;CA)
Waste Management
The Minister's Task Force on Litter Abatement. Report, 14:31148 (R;CA)

NOVAE
Ultraviolet Spectra
UV and optical line emission from the shell of the old nova GK Persei, 14:32447 (RA;FR)

NRTS
See IDAHO NATIONAL ENGINEERING LABORATORY

NUCLEAR ACCIDENTS
See ACCIDENTS

NUCLEAR ATTACKS
See NUCLEAR WEAPONS

NUCLEAR CASCADES
Charged-Particle Transport
Computer experiment for 3.65 GeV proton beam with a lead target for comparison of the MARS4 and HETC computer codes, 14:30842 (R;SU;In Russian)

NUCLEAR CONTROVERSY
See HUMAN POPULATIONS

NUCLEAR DATA COLLECTIONS
Benchmarks
Generation and tests of the new version 88 library for HAMMER system, 14:32994 (R;BR;In Portuguese)
Program of evaluations for nuclear data centers, 14:30859 (R;BR;In Portuguese)
Brazilian Organizations
Activities planning of Nuclear Data Center - 1980, 14:32645 (R;BR;In Portuguese)
Calculation Methods
The relationship between integral experimental data and nuclear fission parameters, 14:30857 (R;US)
Compiled Data
Generation and tests of the new version 88 library for HAMMER system, 14:32994 (R;BR;In Portuguese)

Cross Sections
Activities planning of Nuclear Data Center - 1980, 14:32645 (R;BR;In Portuguese)
Evaluation
Program of evaluations for nuclear data centers, 14:30859 (R;BR;In Portuguese)
France
French studies for improvement of the data for radioactive sources, 14:30856 (R;FR)
Research Programs
Activities planning of Nuclear Data Center - 1980, 14:32645 (R;BR;In Portuguese)

NUCLEAR DEFORMATION
Excitation Functions
Observation of sub-barrier fusion enchancement due to negative hexadecapole deformations, 14:32674 (R;AU)

NUCLEAR DETERRENCE
Defense Nuclear Agency Fiscal Year 1990/91 program document: research, development, test and evaluation, defense agencies (supports congressional budget estimates), 14:31168 (R;US)

NUCLEAR ENERGY
Environmental Impacts
Nuclear energy and the environment, 14:30880 (R;BR;In Portuguese)
Public Opinion
Uncertainties of risk assessment and public attitude study on nuclear energy based on fuzzy measure and fuzzy integral model, 14:30992 (RA;AT)

NUCLEAR ENGINEERING
Semiconductor Materials
Proceedings of the 4. Brazilian School of Semiconductor Physics, 14:32787 (R;BR;In Portuguese)
Uses
Proceedings of the 4. Brazilian School of Semiconductor Physics, 14:32787 (R;BR;In Portuguese)

NUCLEAR EXPLOSIONS
Detection
Seismic coupling of nuclear explosions: Volume 1, 14:31904 (R;US)
Fallout
Bikini accident and Chernobyl accident, 14:32389 (RA;AT)
Heat Flux
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)
Smokes
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)

NUCLEAR FACILITIES
See also ISOTOPE SEPARATION PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
SURPLUS NUCLEAR FACILITIES
Airtightness
Nuclear facility air lock design criteria, 14:30536 (R;US)
Environment
Environmental monitoring program of the uranium enrichment facility Almirante Alvaro Alberto, 14:30624 (R;BR;In Portuguese)
Environmental Impacts
Environmental radioactivity, 14:30879 (RA;BR)
Role de la radioecologie dans l'evaluation de l'impact des activites nucleaires dans l'environnement, 14:30881 (RA;IL)
Radiation Monitoring
Environmental monitoring program of the uranium enrichment facility Almirante Alvaro Alberto, 14:30624 (R;BR;In Portuguese)
Radioecologic control of the surroundings of the Ringhals nuclear power station up to and incl. 1986, 14:32779 (R;SE;In Swedish)
Results of the independent radiological verification survey of the lower Sheffield Brook floodplain, Wayne, New Jersey, 14:32021 (R;US)
Radioisotopes
Intercalibration measurements of gamma radiating nuclides, 14:30888 (R;SE;In Swedish)

NUCLEAR FUEL ELEMENTS
See FUEL ELEMENTS

NUCLEAR FUELS
See also ALLOY NUCLEAR FUELS
MIXED CARBIDE FUELS
SPENT FUELS
Irradiation
Modeling of the behaviour under irradiation of the nuclear fuel containing thorium, uranium and plutonium oxides, 14:30436 (R;RO;In Romanian)
Mixed Carbide Fuels
Alternative fuels for the French fast breeder reactors programme, 14:30848 (R;FR)
Plutonium Nitrides
Alternative fuels for the French fast breeder reactors programme, 14:30848 (R;FR)

NUCLEAR INDUSTRY
Radioecology
Role de la radioecologie dans l'evaluation de l'impact des activites nucleaires dans l'environnement, 14:30881 (RA;IL)

NUCLEAR MAGNETIC RESONANCE
Relaxation
Nuclear magnetic relaxometry: a technique complementary to imaging and spectroscopy, 14:32263 (RA;DD)
Spectroscopy
Nuclear magnetic relaxometry: a technique complementary to imaging and spectroscopy, 14:32263 (RA;DD)

NUCLEAR MATTER
Calculation Methods
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32701 (R;US)
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32702 (R;US)
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32700 (R;US)
Phase Transformations
Correlations between dilepton yields and pion multiplicities as probe of the deconfinement transition, 14:32704 (R;DE)

NUCLEAR MEDICINE
See also RADIOLOGY
Evaluation
American College of nuclear physicians committee to review the facilities report: 1988 edition, 14:32363 (R;US)

NUCLEAR PHYSICS
Meetings
Gross properties of nuclei and nuclear excitations. Proceedings, 14:32722 (R;DE)
Research Programs
Corporate plan 1989, 14:32970 (R;GB)
Reviews
Annual report on nuclear physics activities. July 1, 1987 - June 30, 1988, 14:32648 (R;DE)
United Kingdom
Corporate plan 1989, 14:32970 (R;GB)

NUCLEAR POTENTIAL
See also FISSION BARRIER
Heavy Ion Reactions
Study of nuclear potentials used in heavy ions scattering, 14:32720 (R;RO;In Romanian)

NUCLEAR POWER
Reviews
Nuclear power and the nuclear fuel cycle. A quarterly review of overseas events, 14:30991 (R;AU)

NUCLEAR POWER PLANTS
Accidents
Medical consequences of a nuclear plant accident, 14:30925 (R;SE;In Swedish)
Decommissioning
Decommissioning of the Niederaichbach Nuclear Power Station (KKN) - remote dismantling, 14:30897 (RA;US)
Environment
Developments in environmental monitoring, 14:30882 (RA;AT)
Expert Systems
Expert training systems to enhance plant operations decision making: Final report, 14:30876 (R;US)

Fluid-Structure Interactions
Some studies on fluid structure interaction problems, 14:31653 (R;IN)
Freeze Protection
Freeze sealing (plugging) of piping: A guide for nuclear power plant maintenance personnel, 14:30867 (R;US)
Gaseous Wastes
Monitoring of the /sup 14/C activity in the environment of the nuclear power plant Krsko in Yugoslavia, 14:30884 (RA;AT)
Health Hazards
Medical consequences of a nuclear plant accident, 14:30925 (R;SE;In Swedish)
Inspection
Dosis loads for temporary workers in decontamination and radiation protection engaged in West German nuclear power plants, 14:30915 (RA;AT;In German)
Outages
Dose assessment and medical consequences of radiation exposure of employees of Electricite de France, 14:32771 (RA;AT)
Personnel
Worldwide trends in occupational exposures at nuclear power plants, 14:30914 (RA;AT)
Personnel Dosimetry
Personal doses from beta radiation in Swiss nuclear power plants, 14:32775 (RA;AT;In German)
Pipelines
Microbial corrosion: 1988 workshop proceedings, 14:30865 (R;US)
Planning
How the emergency plans for reactor accidents should be revised, 14:30910 (RA;AT;In German)
Implementing optimization principle in the design of nuclear power plants: regulatory trends in Italy, 14:30854 (RA;AT)
Radiation Protection
Dose assessment and medical consequences of radiation exposure of employees of Electricite de France, 14:32771 (RA;AT)
Recurrent analyses of radiation protection conditions at the Swedish nuclear power plants, 14:30629 (RA;AT)
Radioactive Effluents
Aspects of controlling the radioactive waste water released by nuclear power plants at the Paks NPP, 14:30883 (RA;AT)
Radioactive Waste Management
Radioactive waste volume reduction program at Brunswick Nuclear Project, 14:30542 (RA;US)
Volume reduction program at Crystal River Unit #3, 14:30547 (RA;US)
Radioactive Waste Processing
Iowa Electric's addition of a low level radwaste processing and storage facility to the Duane Arnold Energy Center, 14:30548 (RA;US)
Radwaste evaporator operating experience at Callaway Nuclear Plant, 14:30551 (RA;US)
Steam generator chemical cleaning waste processing at Millstone Unit No. 2, 14:30543 (RA;US)
Radioactive Wastes
Monitoring of the /sup 14/C activity in the environment of the nuclear power plant Krsko in Yugoslavia, 14:30884 (RA;AT)
Reactor Cores
Validation of core debris/concrete interactions and source term models, 14:30921 (R;US)
Reactor Licensing
United States Nuclear Regulatory Commission staff practice and procedure digest: Commission, Appeal Board and Licensing Board decisions, July 1972–September 1988, 14:30852 (R;US)
Reactor Operation
Licensed operating reactors: Status summary report data as of March 31, 1989, 14:30820 (R;US)
Risk Assessment
Final report on a study of coherence in acceptability criteria for the technical aspects of risks associated with potentially hazardous installations, 14:30903 (R;FR)
Waste Water
Criteria for choice of decontaminating agents for trouble-free processing of radioactive waste waters from the control area of nuclear power plants, 14:30568 (RA;AT;In German)
Water
Measurements and calculations on the responses of a NaI(Tl) detector immersed in a water tank containing different radioisotopes, 14:31832 (RA;AT)
Working Conditions
Choice of treshold values triggering the decontamination procedure in nuclear plants working places, 14:32769 (RA;AT)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR REACTION KINETICS
Monte Carlo Method
Importance biasing for 1-D deep-penetration problem by Monte Carlo, 14:32747 (R;IN)

NUCLEAR REACTIONS
See also FISSION
HADRON REACTIONS
HEAVY ION FUSION REACTIONS
INCOMPLETE FUSION REACTIONS
PHOTONUCLEAR REACTIONS
Angular Distribution
Multi-step direct multi-step compound description of fast particle induced reactions, 14:32711 (R;XA)
Cross Sections
Multi-step direct multi-step compound description of fast particle induced reactions, 14:32711 (R;XA)
Exciton Model
Multi-step direct multi-step compound description of fast particle induced reactions, 14:32711 (R;XA)

NUCLEAR REACTORS
See REACTORS

NUCLEAR SAFETY
See RADIATION PROTECTION

NUCLEAR SPIN RESONANCE
See NUCLEAR MAGNETIC RESONANCE

NUCLEAR STRUCTURE
Monte Carlo Method
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32702 (R;US)
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32700 (R;US)
Computational methods for the nuclear and neutron matter problems: Progress report, 14:32701 (R;US)
Pairing Interactions
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)

NUCLEAR WASTE POLICY ACTS
Compliance
A method for evaluating structural transducers used in Type B package testing, 14:30592 (R;US)

NUCLEAR WASTES
See RADIOACTIVE WASTES

NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS

NUCLEAR WEAPONS
Arms Control
Defense Nuclear Agency Fiscal Year 1990/91 program document: research, development, test and evaluation, defense agencies (supports congressional budget estimates), 14:31168 (R;US)
International Atomic Energy Aagency safeguards: observations on lessons for verifying a chemical weapons convention, 14:31171 (R;CA)
Fallout
Radioecological investigations in the Austrian part of the Danube river, 14:32073 (RA;AT)
Nuclear Winter
Environment and nuclear war, 14:32008 (R;BR)
Proliferation
PACOM net assessment: Pakistani and Indian nuclear perceptions. Volume 1. Main report. Final report, 31 January-31 August 1983, 14:31170 (R;US)

Radiation Effects
A 1-D, hard x-ray pinhole camera for flash x-ray pulsed-power accelerators, 14:31869 (R;US)
Testing
A model for global cycling of tritium, 14:32959 (J;US)
Warfare
Nuclear warfare: survival. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31902 (R;US)

NUCLEAR WINTER
Heat Flux
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)
Smokes
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)

NUCLEASE (RIBONUCLEASE)
See RNA-ASE

NUCLEASES
Molecular Structure
Approximation of the Planck-Benzinger thermal work function in protein refolding in ribonuclease systems, 14:32193 (BA;US)

NUCLEI
See also HEAVY NUCLEI
INTERMEDIATE MASS NUCLEI
Electromagnetic Form Factors
Relativistic multipole operators for semileptonic weak and electromagnetic nuclear reactions, 14:32602 (J;US)
M1-Transitions
Mechanisms for spin suppression and orbital enhancement in *M*1 transitions: Critical assessment, 14:32742 (J;US)

NUCLEIC ACIDS
See also DNA
OLIGONUCLEOTIDES
RNA
Biological Evolution
Evolution of the genetic apparatus: a review, 14:32079 (BA;US)
New concepts for dealing with the evolution of nucleic acids, 14:32107 (BA;US)

NUCLEOGENESIS
See NUCLEOSYNTHESIS

NUCLEON REACTIONS
See also NEUTRON REACTIONS
PROTON REACTIONS
Gamma Spectra
Role of pre-equilibrium theory in nuclear data evaluation, 14:32726 (RA;SU)
Neutron Spectra
Role of pre-equilibrium theory in nuclear data evaluation, 14:32726 (RA;SU)

NUCLEON-ANTINUCLEON INTERACTIONS
See also PROTON-ANTIPROTON INTERACTIONS
Annihilation
Anomalous ϕ production in $N\bar{N}$ annihilation: Four-quark exotics or $ss\bar{}$ components in the nucleon?, 14:32606 (J;US)
Exotic mesons in $\bar{N}N$ annihilation, 14:32555 (J;US)

NUCLEON-NUCLEON INTERACTIONS
See also PROTON-NUCLEON INTERACTIONS
Transport Theory
Photon annd pion production in heavy ion collisions, 14:32740 (R;US)

NUCLEOPROTEINS
Biological Functions
Different small nuclear ribonucleoprotein particles are involved in different steps of splicing complex formation, 14:32105 (BA;US)
Biosynthesis
Transcription and replication of influenza virion RNA in the nucleus of infected cells, 14:32111 (BA;US)

NUCLEOSIDES
Chromatography
Evaluation of micellar electrokinetic capillary chromatography for the separation and detection of normal and modified deoxyribonucleosides and deoxyribonucleotides, 14:31444 (J;US)
Fluorescence Spectroscopy
Fluorescence line narrowing spectrometry of nucleoside-polycyclic aromatic hydrocarbon adducts on thin-layer chromatographic plates, 14:31458 (J;US)

NUCLEOSOMES
Dichroism
Preparation and characterization of soluble macronuclear chromatin from the hypotrich Euplotes eurystomus, 14:32198 (J;GB)

NUCLEOSYNTHESIS
R Process
Nucleosynthesis in the fast neutron capture processes, 14:32457 (RA;SU;In Russian)

NUCLEOTIDES
See also ATP
NAD
NUCLEOSIDES
Biosynthesis
Genetic error and genome design, 14:32154 (BA;US)

NUCLIDES
See ISOTOPES

NUTRIENTS
Concentration Ratio
Primary production, nutrients, and particulate matter in the southern California bight: Contributions to the C, N, and O_2 budgets: A component of the California Basin Study (CaBS): [Progress report, November 1988], 14:32438 (R;US)

NYLON
Materials Testing
Nonlinear viscoelastic characteristics of polymeric materials: Final report, September 1, 1986–February 28, 1989, 14:31319 (R;US)

O

OAK RIDGE GASEOUS DIFFUSION PLANT
See ORGDP

OAK RIDGE NATIONAL LABORATORY
See ORNL

OBRIGHEIM REACTOR
Fuel-Cladding Interactions
The Studsvik Super-Ramp Extension Project: Power ramp irradiation of test fuel rod group PK1X, 14:30844 (R;SE)

OCCLUSION COMPLEXES
See CLATHRATES

OCCUPATIONAL DISEASES
Pneumoconiosis in Appalachian bituminous coal miners, 14:30284 (R;US)

OCCUPATIONAL EXPOSURE
Health-hazard evaluation determination report No. 73-123-298, Campbell Plastics, Inc., Schenectady, New York, 14:31962 (R;US)
Health-hazard evaluation determination report No. 74-9-174 Wheeling Steel Corporation, Steubenville, Ohio, 14:31961 (R;US)
Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri, 14:31960 (R;US)
Health-hazard evaluation determination report No. 75-146-254, Custom Furniture and Cabinets, Inc., Post Falls, Idaho, 14:31964 (R;US)
Health-hazard evaluation determination report No. 75-19-276, Masonite Corporation, Evendale, Ohio, 14:31959 (R;US)
Health-hazard evaluation determination report No. 75-87-280, Kawecki Berylco Industries, Inc., Reading, PA, 14:31943 (R;US)
Health-hazard evaluation determination report No. 76-33-431, 76-34-431, Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia, 14:31944 (R;US)

Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana, 14:31947 (R;US)
Health-hazard evaluation determination report No. 77-44-435, Keller Columbus, Inc., Columbus, Ohio, 14:31948 (R;US)
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Hydrazine: usage and exposure in the electric power industry, 14:30808 (R;US)
Industrial-hygiene survey report, Cain Chemical, Inc., Bayport Plant, Pasadena, Texas, June 1-2, 1988, 14:31953 (R;US)
Industrial-hygiene survey report, P. D. George Company, St. Louis, Missouri, February 22-25, 1988, 14:31954 (R;US)
Industrial-hygiene survey report, Wabash Magnetic Company, Huntington, Indiana, May 24-26, 1988 (4,4'-methylenedianiline), 14:31955 (R;US)
Industrial-hygiene survey, Bachmeier and Company, Kearny, New Jersey, November 4-8, 1985, 14:31952 (R;US)
Walk-through survey report, Central Brass Manufacturing Company, Cleveland, Ohio, March 20, 1987, 14:31956 (R;US)

Evaluation
Biological assessment of occupational exposure to actinides: Programme; Book of Abstracts, 14:32368 (R;FR)

Radiation Doses
External occupational radiation exposure in the GDR in 1987, 14:32778 (R;DD;In German)

OCCUPATIONAL SAFETY
Guide for preparing Safe Operating Procedures (SOPs), 14:30983 (R;US)
Health-hazard evaluation determination report No. 76-6-294, J. A. Devine, D.D.S., Cheyenne, Wyoming, 14:31963 (R;US)
Occupational safety and health effects of high-voltage transmission lines, 14:32405 (R;US)

OFF-PEAK ENERGY STORAGE
Economic Analysis
Demand-side load leveling battery storage at the Princeton Plasma Physics Laboratory, 14:30928 (BA;US)

OFFICE BUILDINGS
Air Flow
Air circulation evaluation, 14:31084 (R;CA;In English and French)

Air Quality
Air quality and ventilation in three office buildings, 14:31058 (R;CA;In French)

Energy Analysis
The sum of megabytes equals gigawatts: Energy consumption and efficiency of office PC's and related equipment, 14:31038 (R;US)

Hazardous Materials
Health-hazard evaluation determination report No. 75-121-281, Penn Central Transportation Company, Philadelphia, Pennsylvania, 14:31946 (R;US)

Lighting Systems
Illumination evaluation, 14:31085 (R;CA;In French)

Ventilation
Air quality and ventilation in three office buildings, 14:31058 (R;CA;In French)

OFFSHORE OPERATIONS
Environmental Impacts
Status of the federal-provincial government response to the West Coast offshore exploration environmental assessment panel report, 14:30302 (R;CA)

Radar
Evaluation of two search radar systems for detection of ice masses, 14:31669 (R;CA)

OFFSHORE PLATFORMS
Design
Programme for marine structures. Summary report, 14:31688 (R;NO)

Drilling Rigs
Position controllable working platform in derricks, 14:31689 (R;NO;In Norwegian)

Ducts
Development of cementitious grouts for post-tensioned concrete members use in offshore structures and in the arctic environment. Vol. 3, Evaluation of pulse-echo technology for detection of voids in grouted ducts, 14:31664 (R;CA)

Erosion
Beaufort Sea artificial island erosion data, 14:30303 (R;CA)

Reliability
Probabilistic design of offshore structural systems, 14:31686 (R;DK)

OIL BURNERS
Atomization
Combustion enhancement by induced Rayleigh instability, 14:31681 (R;CA)

Performance
Combustion enhancement by induced Rayleigh instability, 14:31681 (R;CA)

OIL RESIDUES
See PETROLEUM RESIDUES

OIL SAND INDUSTRY
Waste Processing
Design operating manual for heavy oil miniplant, 14:30416 (R;CA)

OIL SAND MINING
Geophysical Surveys
Determining geotechnical and hydrogeological parameters using downhole geophysics in the Canadian plains. Phase 1 report. A review of potential applications, vol. 1, 14:32422 (R;CA)

Mine Haulage
Demonstration and evaluation of an integrated truck management system in a producing Canadian surface coal or oil sands mine, 14:30336 (R;CA)

OIL SAND OILS
See BITUMENS

OIL SANDS
Combustion
The numerical simulation of forward combustion in a tube reactor using the Sunnyside resource, 14:30369 (R;US)

Permeability
Three-phase relative permeability of Asphalt Ridge tar sand, 14:30391 (R;US)

OIL SHALE DEPOSITS
Exploration
Current situation with respect to oil shale research and the use of oil shale in the Federal Republic of Germany, 14:30325 (RA;CN)
Oil shale activities in Morocco, 14:30326 (RA;CN)

Geochemistry
Organic geochemistry of the onshore Kimmeridge clay oil shale of Britain, 14:30333 (RA;CN)

Geologic History
Conditions of kukersite deposition, 14:30331 (RA;CN)
Feature of distribution and suggestion on the development and utilization of oil shale in China, 14:30329 (RA;CN)

Geology
Geological types of oil shale deposits in China, 14:30328 (RA;CN)
Geology of New Brunswick oil shales, eastern Canada, 14:30330 (RA;CN)
Oil shale in central Jordan, 14:30327 (RA;CN)
Relationship between oil shales and low-matured heavy oil pools in Huanghua depression, 14:30332 (RA;CN)

Stratigraphy
Commercial zonation of the Estonia oil shale deposit, 14:30334 (RA;CN)

OIL SHALE FINES
Explosions
Preferred explosives for blasting in oil shale mines, 14:30335 (RA;CN)

Flammability
Prevention of oil shale dust explosions, 14:30417 (RA;CN)

Flotation
Study on the viability of upgrading Brazilian shale fines through flotation, 14:30342 (RA;CN)

Fluidized-Bed Combustion
Development of oil shale retorting plant in Japan. Part II. Operation of the pilot plant, 14:30355 (RA;CN)
Modified-in-situ technology combined with aboveground retorting and circulating fluid bed combustors could offer a viable method to unlock oil shale reserves in the near future, 14:30360 (RA;CN)

Retorting
Retorting of four kinds of small size oil shale with an inclining type retort, 14:30352 (RA;CN)

OIL SHALE INDUSTRY
Economic Development
Ideas on the development of Maoming oil shale and shale oil industry, 14:30415 (RA;CN)

Economics
Potential production of specialty chemicals from oil shale in the United States, 14:30412 (RA;CN)
Prospect of oil shale and shale oil industry, 14:30410 (RA;CN)

Historical Aspects
Ahead of our time, 14:30411 (RA;CN)

OIL SHALE MINING
Chemical Explosives
Preferred explosives for blasting in oil shale mines, 14:30335 (RA;CN)

Planning
Commercial zonation of the Estonia oil shale deposit, 14:30334 (RA;CN)
Oil shale activities in Morocco, 14:30326 (RA;CN)

Technology Assessment
Shale oil industry in Maoming, 14:30414 (RA;CN)

OIL SHALE PROCESSING PLANTS
Commercialization
Oil shale industrialization in Brazil, 14:30367 (RA;CN)

Economic Analysis
Economic assessment of the Fushun type commercial shale oil plant, 14:30413 (RA;CN)

Economics
Modified-in-situ technology combined with aboveground retorting and circulating fluid bed combustors could offer a viable method to unlock oil shale reserves in the near future, 14:30360 (RA;CN)

Environmental Quality
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report, third quarter, 1988. Report for 1 July-30 September 1988, 14:30424 (R;US)
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. Second quarter 1988. Report for 1 April-30 June 1988, 14:30423 (R;US)
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. First quarter 1988. Report for 1 January-31 March 1988, 14:30422 (R;US)
UNOCAL Parachute Creek Shale Oil Project. Monitoring review committee meeting report. Annual meeting, 1987-1988, 14:30425 (R;US)

Performance
Development of oil shale retorting plant in Japan. Part II. Operation of the pilot plant, 14:30355 (RA;CN)
Unocal Corporation's commercial experience in upgrading shale oil to produce a high quality syncrude, 14:30362 (RA;CN)

Performance Testing
Development of an oil shale fines pyrolysis technology, 14:30350 (RA;CN)

Planning
Upgrading Julia Creek shale oil - syncrude or fully refined products, 14:30363 (RA;CN)

Technology Assessment
Shale oil industry in Maoming, 14:30414 (RA;CN)

Waste Water
Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
Industrial testing of retorting waste water treatment in towered biological filtration pond, 14:30419 (RA;CN)

OIL SHALE WASTE WATER
See OIL SHALES
WASTE WATER

OIL SHALES
Ammonolysis
Liquefaction of oil shales in different solvents and reagents, 14:30339 (RA;CN)

Chemical Analysis
Comparison between Chinese and Colorado oil shales, 14:30380 (RA;CN)
High resolution transmission electron microscopy (TEM) in the study of oil shales, 14:30378 (RA;CN)

Chemical Composition
Feature of distribution and suggestion on the development and utilization of oil shale in China, 14:30329 (RA;CN)

Chemical Properties
Organic geochemistry of the onshore Kimmeridge clay oil shale of Britain, 14:30333 (RA;CN)
Utilization of Estonian oil shale at thermal power plants, 14:30409 (RA;CN)

Combustion
Oil shale activities in Morocco, 14:30326 (RA;CN)
Thermal fatigue cracking of Estonian oil-shale-fired boilers' tubes caused by on-load water deslagging, 14:30403 (RA;CN)

Combustion Kinetics
Utilization of Estonian oil shale at thermal power plants, 14:30409 (RA;CN)

Dehydration
Mechanism of low-temperature water evolution from Green River Formation oil shale, 14:30394 (R;US)

Drying
Drying mechanism and kinetics model of lump-size Maoming oil shale with high moisture content, 14:30341 (RA;CN)

Electrorefining
Dissociation of organic and mineral matrix of Maoming oil shale at low-temperature and ambient-atmosphere, 14:30337 (RA;CN)

Explosive Fracturing
Advances in fragmentation for in situ bed production, 14:30358 (RA;CN)
Significance of dilatancy to in situ bed preparation, 14:30359 (RA;CN)

Fischer Assay
Comparison of Fischer assay shale oils produced from different oil shales, 14:30389 (RA;CN)
Factors affecting the results of Fischer assay of oil shale, 14:30381 (RA;CN)

Fluidized-Bed Combustion
Current situation with respect to oil shale research and the use of oil shale in the Federal Republic of Germany, 14:30325 (RA;CN)
Fluid-bed boiler burning particulate Maoming oil shale, 14:30401 (RA;CN)
Fluidized bed combustion of Thai oil shale, 14:30400 (RA;CN)
Initiation and development of fluidized-bed boilers for oil shale in China, 14:30408 (RA;CN)
Self-desulphurating characteristics of high sulfur oil shale in fluidized bed combustor, 14:30399 (RA;CN)

Gasification
Swedish shale gasification research program, 14:30366 (RA;CN)

Hydrogenation
Liquid fuel from oil shales by hydrogenation and aqueous conversion, 14:30340 (RA;CN)

Multi-Element Analysis
Neutron activation analysis possibilities for the elemental composition research in oil-shales, oil-bituminous rocks, petroleum and their fractions, 14:30379 (RA;CN)

Oil Yields
Application of pyrolysis gas chromatography to examination of behavior in retorting of various oil shales, 14:30386 (RA;CN)
Comparison of extracts and yields from the thermal solution of a typical Green River oil shale and a Sunbury oil shale, 14:30384 (RA;CN)

Dependence of the yield and properties of semicoking oils on the mineral content and composition of oil shales, 14:30388 (RA;CN)
Fluidized-bed retorting of Australian oil shales, 14:30390 (RA;CN)
Hydroretorting, rock-eval, and Fischer assay analyses of some world oil shales, 14:30383 (RA;CN)
Mechanism of hydrocarbon generation from fushun oil shale kerogen as viewed by high field solid state C-13 n.m.r. spectroscopy, 14:30387 (RA;CN)

Origin
Conditions of kukersite deposition, 14:30331 (RA;CN)

Oxidation
Aspects of nonfuel utilization of oil shales based on their oxidation, 14:30395 (RA;CN)
Electrochemical oxidation of oil shale, 14:30396 (RA;CN)
Study of oxidation technique of oil shale, 14:30382 (RA;CN)

Petrology
Geology of New Brunswick oil shales, eastern Canada, 14:30330 (RA;CN)

Processing
Prospect of oil shale and shale oil industry, 14:30410 (RA;CN)

Production
Ideas on the development of Maoming oil shale and shale oil industry, 14:30415 (RA;CN)

Pyrolysis
Characterization of flash pyrolysis products from Green River shale, 14:30347 (RA;CN)
Development of an oil shale fines pyrolysis technology, 14:30350 (RA;CN)
Eastern oil shale conversion using the ROPE [Recycle Oil Pyrolysis and Extraction] process, 14:30370 (R;US)
Investigation on pyrolysis of Huangxian oil shale between 550° 750°C, 14:30344 (RA;CN)
Isothermal pyrolysis and char combustion of oil shales, 14:30343 (RA;CN)
Study of gas evolution during oil shale pyrolysis by TQMS, 14:30346 (RA;CN)
Thermal decomposition of New Brunswick oil shale, 14:30397 (RA;CN)

Research Programs
Status of oil shale developments and supporting research in Australia, 14:30324 (RA;CN)
Swedish shale gasification research program, 14:30366 (RA;CN)

Reserves
Oil shale in central Jordan, 14:30327 (RA;CN)

Resource Development
Status of oil shale developments and supporting research in Australia, 14:30324 (RA;CN)

Retorting
Comparison between Chinese and Colorado oil shales, 14:30380 (RA;CN)
Current situation with respect to oil shale research and the use of oil shale in the Federal Republic of Germany, 14:30325 (RA;CN)
Design of a new oil shale retort for China's fushun region, 14:30353 (RA;CN)
Development of oil shale retorting plant in Japan. Part II. Operation of the pilot plant, 14:30355 (RA;CN)
Economic assessment of the Fushun type commercial shale oil plant, 14:30413 (RA;CN)
Kinetics of the cracking and coking of oil shale vapors and their relevance to the processing of Australian oil shales, 14:30348 (RA;CN)
Large capacity aggregates for retorting lump oil shale, 14:30356 (RA;CN)
Maoming and Huadian oil shale retorting using solid heat carrier, 14:30354 (RA;CN)
Oil shale activities in Morocco, 14:30326 (RA;CN)
Oil shale industrialization in Brazil, 14:30367 (RA;CN)
Oil shale retorting in dense phase hot-solid recycle systems, 14:30351 (RA;CN)
Reactor-combustor fluidized bed retorting of Maoming oil shale, 14:30349 (RA;CN)
Sixty years of oil shale retorting industry in Fushun, 14:30368 (RA;CN)

Semicoking
Liquid fuel from oil shales by hydrogenation and aqueous conversion, 14:30340 (RA;CN)

Solvent Extraction
Liquid fuel from oil shales by hydrogenation and aqueous conversion, 14:30340 (RA;CN)

Structural Chemical Analysis
Dissociation of organic and mineral matrix of Maoming oil shale at low-temperature and ambient-atmosphere, 14:30337 (RA;CN)
Investigation of the structure of kerogens based on the oxidation products from multistep alkaline permanganate degradation, 14:30375 (RA;CN)
Petroporphyrins in several oil shales, China, 14:30374 (RA;CN)
Structural characterization of the kerogen from Pumpherston oil shale, 14:30376 (RA;CN)
Variations in the composition of steranes and triterpanes in oil shales of different origins and stages of maturity, 14:30373 (RA;CN)

Supercritical Gas Extraction
Liquefaction of oil shales in different solvents and reagents, 14:30339 (RA;CN)
Supercritical extraction of Chinese oil shales, 14:30338 (RA;CN)

Thermal Conductivity
Thermal properties of Chinese oil shale - measurement of thermal conductivity of oil shale, 14:30377 (RA;CN)

OIL SPILL FINGERPRINTING
See OIL SPILLS

OIL SPILLS
Computerized Simulation
Development of an oil spill simulation model for the Saint-Lawrence River, 14:30304 (R;CA;In French)

Mathematical Models
Development of an oil spill simulation model for the Saint-Lawrence River, 14:30304 (R;CA;In French)

OIL WELLS
Enhanced Recovery
Modified corresponding states method for predicting densities of petroleum reservoir fluids, 14:30294 (J;US)

Pipes
The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel, 14:31236 (BA;US)

Well Stimulation
Modified corresponding states method for predicting densities of petroleum reservoir fluids, 14:30294 (J;US)

OKG-2 REACTOR
Fuel Scanning
Base irradiation history report of ASEA-ATOM fuel rods for the Super-Ramp Extension Project, 14:30827 (R;SE)

Fuel-Cladding Interactions
Fabrication and characterization of ASEA-ATOM fuel rods for the Super-Ramp Extension Project: The Super-Ramp Extension Project, 14:30826 (R;SE)

Gamma Fuel Scanning
Hot cell interim examination of OII stringer rod OA1: The Super-Ramp Extension Project, 14:30828 (R;SE)

OLEFINS
See ALKENES

OLIGONUCLEOTIDES
Biosynthesis
Prebiotic synthesis: problems and challenges, 14:32081 (BA;US)

OLIGOSACCHARIDES
Molecular Structure
Electrostatics and molecular recognition, 14:32183 (BA;US)

OLIVINE
Atom Transport
Oxygen diffusion in olivine: Effect of oxygen fugacity and implications for creep, 14:32436 (J;US)

Electric Conductivity
Electrical conduction in olivine, 14:32437 (J;US)

OLIVINES
See OLIVINE

OMEGA MINUS
See OMEGA PARTICLES
OMEGA PARTICLES
Particle Production
Recent results on S = −3 baryon spectroscopy from the LASS [Large Aperture Superconducting Solenoid] spectrometer, 14:32549 (R;US)
OMEGA-1778 RESONANCES
See MESONS
ON-LINE COMPUTERS
See COMPUTERS
ON-LINE CONTROL SYSTEMS
Beam Optics
Control system of magnetic optical element power supplies for some beam channels, 14:31741 (R;SU;In Russian)
ON-LINE MEASUREMENT SYSTEMS
Gamma Spectroscopy
On-line measurement system of multidimensional spectra with real time digital preprocessing of experimental information, 14:31819 (R;SU;In Russian)
Ion Exchange Chromatography
On-line monitor for cation exchange elution chromatography using lithium silicate glass beads as solid scintillator, 14:31806 (R;CN;In Chinese)
Spectra Unfolding
On-line measurement system of multidimensional spectra with real time digital preprocessing of experimental information, 14:31819 (R;SU;In Russian)
ON-SITE POWER GENERATION
Renewable Energy Sources
Humleby's heating supplies. Investigation of the possibilities for establishing local heat supply based on renewable energy in the Humleby area, 14:31147 (R;DK;In Danish)
ONCOGENIC TRANSFORMATIONS
Cpb
Investigation of the induction of oxidative DNA damage by means of an enzyme-linked immunosorbent assay (ELISA) for thymine glycol containing DNA, 14:32208 (R;DE;In German)
Enzyme Immunoassay
Investigation of the induction of oxidative DNA damage by means of an enzyme-linked immunosorbent assay (ELISA) for thymine glycol containing DNA, 14:32208 (R;DE;In German)
ONDULATOR RADIATION
Electromagnetic radiation shaping in a plane ondulator with groved pole surface, 14:31716 (R;SU;In Russian)
ONTARIO
Acid Rain
Acid precipitation in Ontario study, annual program report, 1987/1988, 14:31935 (R;CA)
Effects of acidic precipitation and related pollutants in the terrestrial environment. A program description, 14:31997 (R;CA)
Air Quality
Air quality survey in the vicinity of the Petro-Canada Trafalgar Refinery, Oakville, Ontario, 14:30305 (R;CA)
Ambient air quality during the pre start up period of the Victoria Hospital energy-from-waste plant, 14:31934 (R;CA)
Ceramics Industry
A technology status report energy usage and microwave heating potential in Ontario ceramics industry, 14:31120 (R;CA)
Electric Utilities
Cost escalators. Annual review, 14:31032 (R;CA)
Energy
Ontario Ministry of Energy annual report, 1987/88, 14:31001 (R;CA;In English and French)
Energy Conservation
Radiant wave technology. As a source of energy savings, 14:31119 (R;CA)
Seasonal Thermal Energy Storage
Aquifer thermal energy storage experience with the Scarborough field trial, 14:30957 (RA;CA;In English and French)
OPEN PLASMA DEVICES
Diffusion
Effect of magnetic system errors on the transport processes in long solenoids, 14:32920 (R;SU;In Russian)
Plasma Confinement
Effect of magnetic system errors on the transport processes in long solenoids, 14:32920 (R;SU;In Russian)
OPERATION
Mathematical Models
Modeling the design and operations of the federal radioactive waste management system, 14:30523 (R;US)
OPTICAL FIBERS
Defects
Study of defect centres in irradiated optical fibre glasses by electron spin resonance spectroscopy, 14:31315 (R;GB)
Irradiation
Study of defect centres in irradiated optical fibre glasses by electron spin resonance spectroscopy, 14:31315 (R;GB)
Uses
Optical fibers and sensors for chemistry, 14:31589 (R;FR)
Wave Propagation
Simple spectral method for solving propagation problems in cylindrical geometry with fast Fourier transforms, 14:32845 (J;US)
OPTICAL FILTERS
Extreme Ultraviolet Radiation
Transmission filter for the extreme ultraviolet spectral region composed of a thin Saran ($C_2H_2Cl_2$) foil, 14:31887 (J;US)
Fabrication
Transmission filter for the extreme ultraviolet spectral region composed of a thin Saran ($C_2H_2Cl_2$) foil, 14:31887 (J;US)
Quantum Efficiency
Cesium laser-excited optical filter, 14:31643 (BA;US)
OPTICAL SYSTEMS
Design
Simple compact monochromatic imaging system for plasma diagnostics, 14:31888 (J;US)
OPTICS
Phase Studies
Direct phase estimation from phase differences using fast elliptic PDE [partial differential equation] solvers, 14:31607 (R;US)
ORBITS
Corrections
Understanding and improving the high field orbit in the Fermilab Booster, 14:31715 (R;US)
Time Dependence
Erratic time dependence of orbits of topologically mixing maps, 14:32820 (R;XA)
ORE PROCESSING
Leaching
Acid lixiviation of phophorite minerals for uranium extraction, 14:30429 (R;BR;In Spanish)
Phosphorites
Acid lixiviation of phophorite minerals for uranium extraction, 14:30429 (R;BR;In Spanish)
ORGANIC ACIDS
See also CARBOXYLIC ACIDS
SULFONIC ACIDS
Solvent Properties
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
ORGANIC BROMINE COMPOUNDS
Electronic Structure
Resonance Raman studies of substituent effects on the electronic structure of phenoxyl radicals, 14:31513 (J;US)
ORGANIC CHLORINE COMPOUNDS
See also CHLORINATED AROMATIC HYDROCARBONS
METHYLENE CHLORIDE
Chemical Reaction Kinetics
Energy distribution of the CN products of the H+HCN, H+ClCN, and F+HCN reactions, 14:31544 (J;US)
Electronic Structure
Resonance Raman studies of substituent effects on the electronic structure of phenoxyl radicals, 14:31513 (J;US)
Radiation Chemistry
Radiation-induced polymerization of cyclophosphazene trimers. Final report, 1 September 1985-30 September 1988, 14:31568 (R;US)

ORGANIC COMPOUNDS
See also ALDEHYDES
AMINES
AROMATICS
ESTERS
HETEROCYCLIC COMPOUNDS
HYDROCARBONS
HYDROXY COMPOUNDS
KETONES
LIPIDS
NUCLEIC ACIDS
NUCLEOTIDES
ORGANIC ACIDS
ORGANIC MERCURY COMPOUNDS
ORGANIC NITROGEN COMPOUNDS
ORGANIC OXYGEN COMPOUNDS
ORGANIC PHOSPHORUS COMPOUNDS
ORGANIC POLYMERS
ORGANIC SULFUR COMPOUNDS
ORGANOMETALLIC COMPOUNDS
PROTEINS
TERPENES

Activation Analysis
Determination of selenium metabolites in biological fluids using instrumental and molecular neutron activation analysis, 14:31459 (J;US)

Adsorption
Carbonaceous solids as a model for adsorption by dispersion forces, 14:31516 (J;US)

Air Pollution Monitors
Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)

Biosynthesis
Which organic compounds could have occurred on the prebiotic earth?, 14:32080 (BA;US)

Chemical Preparation
Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)

Chemical Reaction Kinetics
A classical trajectory study of intramolecular vibrational relaxation and unimolecular decomposition in methyl hydroperoxide, 14:31543 (J;US)

Chemical Reactions
Synthesis of an (η^3-allyl(hydrido)iridium complex and its reactions with arenes and alkanes. Sequential intermolecular C-H oxidative addition and hydride-to-alkene migratory insertion reactions, 14:31502 (J;US)

Combustion
The potential of continuous emission monitoring of hazardous waste incinerators using Fourier transform infrared spectroscopy, 14:31919 (R;US)

Ecological Concentration
Assessing tap-water contributions to inhalation exposure for volatile organic chemicals, 14:31094 (R;US)
Dutch priority programme on acidification: Summary report, Acidification research, 1984–1988, 14:31969 (R;NL)

Molecular Structure
Local structure evaluation in solid organophosphorus compound by double cross polarization carbon-13 nuclear magnetic resonance spectroscopy, 14:31521 (J;US)

Particulates
Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri, 14:31960 (R;US)

Photolysis
Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid, 14:30447 (J;US)

Physical Properties
Chemical data for predictinng the fate of organic compounds in water: Volume 1, Technical basis: Final report, 14:32035 (R;US)

Raman Spectroscopy
Silver-coated fumed silica as a substrate material for surface-enhanced raman scattering, 14:31409 (J;US)

Supercritical Fluid Chromatography
Direct heated interface probe for capillary supercritical fluid chromatography/double focusing mass spectrometry, 14:31461 (J;US)

Toxicity
DOE contractors' meeting on chemicals with living systems, 14:32395 (R;US)

Volatile Matter
Analytical procedures for environmental quality control. Volume 1. Technical report, 14:32041 (R;US)
Analytical procedures for environmental quality control. Volume 2. Technical report, 14:32042 (R;US)
Analytical procedures for environmental quality control. Volume 3. Technical report, 14:32043 (R;US)
Annual report on performance-audit results for POHC (Principal Organic Hazardous Constituents) testing during RCRA trial burns, 14:31989 (R;US)
Sorption of selected volatile organic constituents of jet fuels and solvents on natural sorbents from gas and solutions phases. Final report, April 1985-September 1987, 14:30298 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 1: comparison of CB4 and CAL mechanisms. Final report, April 1986-September 1988, 14:31939 (R;US)

ORGANIC FLUORINE COMPOUNDS
Electronic Structure
Resonance Raman studies of substituent effects on the electronic structure of phenoxyl radicals, 14:31513 (J;US)

Solvent Properties
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)

ORGANIC ION EXCHANGERS
See also POLYSTYRENE-DVB

Thermodynamic Properties
Organic resin anion exchangers for the treatment of radioactive wastes, 14:30533 (R;GB)

ORGANIC MERCURY COMPOUNDS
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)

ORGANIC NITROGEN COMPOUNDS
See also AMIDES
AZO COMPOUNDS
NITRILES
NITRO COMPOUNDS
OXIMES
PORPHYRINS

Chemical Reaction Kinetics
Energy distribution of the CN products of the H+HCN, H+ClCN, and F+HCN reactions, 14:31544 (J;US)

Crystal Structure
Crystal structures of $(MeC_5H_4)_4U_2(\mu\text{-}NR)_2$. Unsymmetrical bridging, R = Ph, and symmetrical bridging, R = $SiMe_3$, organoimide ligands in organoactinide compounds, 14:31578 (J;US)

Excitation
Energy transformation in molecular electronic systems: Comprehensive progress report, 1986–1989, 14:31472 (R;US)

Gas Chromatography
Capillary gas chromatographic separation of alkyl nitrates and peroxycarboxylic nitric anhydrides, 14:31411 (J;US)

Occupational Exposure
Hydrazine: usage and exposure in the electric power industry, 14:30808 (R;US)
Separation Processes
Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Detailed separation and analysis of basic compounds, 14:30312 (R;US)

ORGANIC OXYGEN COMPOUNDS
See also ETHERS
FURANS
PYRANS
QUINONES
RHODAMINES
Synthesis
Regioselective synthesis of substituted 1-thiohex-2-enopyranosides, 14:31487 (J;US)

ORGANIC PHOSPHORUS COMPOUNDS
See also PHOSPHONATES
Decomposition
C-H insertion and π-complex formation reactions of $(\eta^5\text{-}C_5Me_5)(PMe_3)Ir$ with ethylene: an intra- and intermolecular isotope effect study, 14:31525 (J;US)

ORGANIC POLYMERS
See also POLYAMIDES
POLYETHYLENE GLYCOLS
RESINS
RUBBERS
Chemical Preparation
Novel bifunctional resins in metal ion separations: ion exchange/coordination resins and ion exchange/precipitation resins, 14:31445 (J;US)

ORGANIC SOLVENTS
Reprocessing
Restoring solvent for nuclear separation processes, 14:30444 (J;US)
Solvent Properties
Analysis of cobalt extraction by di-(2-ethylhexyl) phosphoric acid in a continuous flow stirred tank with a laser capillary spectrophotometer, 14:31421 (J;US)
Effects of solvents, axial ligation, and radical cation formation on the V=O stretching Raman frequency in vanadyl porphyrins: implications for peroxidase intermediates, 14:31498 (J;US)
Recovery of plutonium and americium from chloride salt wastes by solvent extraction, 14:30431 (J;US)
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)
TRUEX process and the management of liquid TRU waste, 14:30619 (J;US)
Thermodynamic modeling of chemical equilibria in metal extraction, 14:31420 (J;US)
Supercritical State
Reverse micelle supercritical fluid separations, 14:31452 (J;US)

ORGANIC SULFUR COMPOUNDS
See also ISOTHIOCYANATES
SULFONES
SULFONIC ACIDS
THIOLS
THIOPHENE
Flame Photometry
Characterization and optimization of flame photometric detection in supercritical fluid chromatography, 14:31399 (J;US)
Separation Processes
Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Detailed separation and analysis of basic compounds, 14:30312 (R;US)
Synthesis
Regioselective synthesis of substituted 1-thiohex-2-enopyranosides, 14:31487 (J;US)

ORGANIC WASTES
Staged Combustion
Investigation of a newly developed, multistage combustion system, 14:31580 (R;DE;In German)

ORGANOMETALLIC COMPOUNDS
Crystal Structure
Crystal structures of $(MeC_5H_4)_4U_2(\mu\text{-}NR)_2$. Unsymmetrical bridging, R = Ph, and symmetrical bridging, R = $SiMe_3$, organoimide ligands in organoactinide compounds, 14:31578 (J;US)
Metallography
Laser-written metallization patterns for solar cell applications, 14:31340 (BA;US)
Photolysis
Ultraviolet absorption of the vinyl radical and reaction with oxygen, 14:31567 (J;US)
Structural Chemical Analysis
High-pressure spectroscopic studies of ferrocene, nickelocene, and ruthenocene, 14:31503 (J;US)
Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene, 14:31504 (J;US)

ORGDP
Decontamination
Nondestructive assay measurements of gaseous diffusion process equipment, 14:30625 (R;US)

ORNL
Emergency Plans
Countermeasures to hazardous chemicals, 14:31936 (R;US)
Research Programs
Environmental Sciences Division annual progress report for period ending September 30, 1988, 14:31937 (R;US)

OSCILLATION MODES
Conversion
Analytic expression for mode conversion of Langmuir and electromagnetic waves, 14:32537 (J;US)

OSCILLATIONS (PLASMA)
See PLASMA WAVES

OSCILLATORS
Hysteresis
Characterization of modulated integrate-and-fire systems, 14:32830 (R;DK)
Local hysteresis in relaxation oscillators, 14:32831 (R;DK)
Phase Transformations
Non-chaotic transition from quasiperiodicity to complete phase-locking, 14:32829 (R;DK)

OSKARSHAMN-2 REACTOR
See OKG-2 REACTOR

OSMIUM 192
Quadrupole Moments
Electric quadrupole moments of the first excited state of /sup 192/Os, 14:32679 (R;AU)

OSTEOSARCOMAS
Computerized Tomography
Value of CT in monitoring preoperative chemotherapy of osteosarcomas, 14:32319 (RA;DD;In German)

OUTAGES
Economic Impact
Farm losses resulting from electric service interruption, 14:31132 (R;CA)

OVERVOLTAGE
Information Dissemination
Electicity supply voltage problems, 14:30817 (R;CA)

OXALIC ACID
Photolysis
Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid, 14:30447 (J;US)

OXETANE
See ETHERS

OXIDASES
See OXIDOREDUCTASES

OXIDES
See also ALUMINIUM OXIDES
BARIUM OXIDES
BERYLLIUM OXIDES
BISMUTH OXIDES
BORON OXIDES
CADMIUM OXIDES
CALCIUM OXIDES

CHROMIUM OXIDES
COBALT OXIDES
COPPER OXIDES
ERBIUM OXIDES
EUROPIUM OXIDES
FLUORINE OXIDES
GADOLINIUM OXIDES
IRIDIUM OXIDES
IRON OXIDES
LANTHANUM OXIDES
LEAD OXIDES
LITHIUM OXIDES
MAGNESIUM OXIDES
MANGANESE OXIDES
NEPTUNIUM OXIDES
NICKEL OXIDES
NITROGEN OXIDES
PLUTONIUM OXIDES
POTASSIUM OXIDES
PRASEODYMIUM OXIDES
RUTHENIUM OXIDES
SILICON OXIDES
STRONTIUM OXIDES
SULFUR OXIDES
THALLIUM OXIDES
THORIUM OXIDES
TITANIUM OXIDES
TRITIUM OXIDES
URANIUM OXIDES
VANADIUM OXIDES
YTTRIUM OXIDES
ZINC OXIDES
ZIRCONIUM OXIDES

Radiolysis
Hydrolytic and radiolytic degradation of OϕD (iB)CMPO; continuing studies, 14:31571 (J;US)

Solvent Properties
Recovery of plutonium and americium from chloride salt wastes by solvent extraction, 14:30431 (J;US)
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
TRUEX process and the management of liquid TRU waste, 14:30619 (J;US)
Thermodynamic modeling of chemical equilibria in metal extraction, 14:31420 (J;US)

OXIDOREDUCTASES
See also OXYGENASES

Biochemical Reaction Kinetics
Implications for enzymic catalysis from free-energy reaction coordinate profiles, 14:32142 (BA;US)

Genes
Cloning of the xylulokinase gene for improved yeast xylose fermentation. I.Cloning the yeast xylulokinase gene by complementation of E. coli xylulokinase mutation, 14:30733 (RA;US)

Molecular Structure
Lactobacillus leichmannii and Escherichia coli ribonucleotide reductases: chemical and structural similarities, 14:32137 (BA;US)
Structural and evolutionary aspects of the key enzymes in photorespiration; RuBisCO and glycolate oxidase, 14:32126 (BA;US)
Thermodynamic calculations on biological molecules, 14:32191 (BA;US)

OXIMES
Solvent Properties
Monolayer behavior of hydroxyoxime extractants, 14:31419 (J;US)

OXINE
Chemical Reactions
Kinetics of the complexation of nickel (II) with 8-hydroxyquinoline in aqueous solution, 14:31488 (J;US)

OXOPROPANE
See ACETONE

OXYGEN
Chemisorption
Comparative study of angle-resolved valence-band photoemission from half-monolayer structures of C, N, and O on Ni(100), 14:31259 (J;US)

Diffusion
Electrocatalysis of anodic oxygen-transfer reactions at doped lead dioxide, 14:31051 (BA;US)
Oxygen diffusion in olivine: Effect of oxygen fugacity and implications for creep, 14:32436 (J;US)

Electron-Molecule Collisions
Subexcitation electrons in gas phase, 14:32489 (R;US)

Production
Characterization of lunar ilmenite resources, 14:32431 (R;US)

Separation Processes
Study of nonsteady-state continuous membrane column for gas separation, 14:31438 (J;US)

OXYGEN 16
Giant Resonance
Monopole and quadrupole vibrations of a hot nucleus, 14:32705 (R;DE)

OXYGEN 16 REACTIONS
Heavy Ion Fusion Reactions
Fusion of $^{16}O + {}^{40}Ca$ at $E_{lab}(^{16}O)$=13.4 MeV/nucleon, 14:32668 (J;US)

Multiple Production
Fluctuations and intermittency in 200 A GeV /sup 16/O + (C, Au) reactions, 14:32706 (R;DE)

OXYGEN 16 TARGET
Photonuclear Reactions
Measurement of $^{16}O(\gamma,n)^{15}O$ at medium energies, 14:32658 (J;US)

OXYGEN COMPLEXES
Structural Chemical Analysis
Oxomanganese(IV) porphyrins identified by resonance Raman and infrared spectroscopy: weak bonds and the stability of the half-filled t_{2g} subshell, 14:31499 (J;US)

OXYGEN COMPOUNDS
See also ALUMINATES
CARBONATES
CHLORATES
CUPRATES
MOLYBDATES
NITRATES
OXIDES
PERTECHNETATES
PHOSPHATES
SELENITES
SULFITES
TUNGSTOPHOSPHATES
VANADATES
WATER

Chemical Reaction Kinetics
Oxygen fluoride chemical kinetics, 14:31547 (J;US)

Chemical Reactions
Oxygen fluoride chemical kinetics, 14:31547 (J;US)
Time-resolved reaction of $O_2(^1\Delta)$ with I^- in aqueous solution, 14:31537 (J;US)
Ultraviolet absorption of the vinyl radical and reaction with oxygen, 14:31567 (J;US)

Thermodynamic Properties
Thermodynamic Properties of Dioxygen Difluoride (O_2F_2) and Dioxygen Fluoride (O_2F), 14:31486 (J;US)

OXYGEN EFFECT (RADIOBIOLOGY)
See OXYGEN

OXYGEN FLUORIDES
See FLUORINE OXIDES

OXYGEN HYDRIDES
See WATER

OXYGEN IONS
Charge-Exchange Reactions
Metastable enhancement of C^+ and O^+ capture reactions: Annual report, July 1, 1988–June 30,1989, 14:32491 (R;US)

OXYGENASES
See also MIXED-FUNCTION OXIDASES
Biological Evolution
Some evolutionary relationships of the primary biological catalysts glutamine synthetase and RuBisCO, 14:32125 (BA;US)
OXYMETHYLENE
See FORMALDEHYDE
OZONE
Biological Effects
Adequacy of forestry data in assessing the impact of ozone: A national perspective, 14:31921 (R;US)
Environmental Effects
Evaluating CFC [chlorofluorocarbon] alternatives from the atmospheric viewpoint, 14:31974 (R;US)
Environmental Exposure
Occupational safety and health effects of high-voltage transmission lines, 14:32405 (R;US)
Photolysis
Photochemistry of O_3/HNCO mixtures, 14:31562 (J;US)

P

P CODES
PVREG - A photovoltaic voltage regulation investigation tool: Program reference manual, 14:30748 (R;US)
PVREG – a photovoltaic voltage regulation investigation tool: PVREG user's manual, 14:30747 (R;US)
P-N JUNCTIONS
Radiation Detectors
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)
PACIFIC NORTHWEST LABORATORIES
See BATTELLE PACIFIC NORTHWEST LABORATORIES
PACKAGING
Biodegradation
Packaging-materials biodegradation. January 1973-April 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-April 1989, 14:30982 (R;US)
Dose Rates
Dose rates of waste packagings. A manual for activity determination of single radionuclide mixtures in standardized waste packagings resulting from dose rate limits, 14:30574 (R;DE;In German)
Evaluation
Design aspects of plutonium air-transportable packages, 14:30600 (R;US)
Heat transfer in severe accident simulations, 14:30601 (R;US)
Testing
A method for evaluating structural transducers used in Type B package testing, 14:30592 (R;US)
PACKED BED
Efficiency
Multicomponent fixed-bed ion exchange: verification of equilibrium coherence theory, 14:31442 (J;US)
PAH
See POLYCYCLIC AROMATIC HYDROCARBONS
PAINTS
Quantitative Chemical Analysis
Transient infrared emission spectroscopy, 14:31407 (J;US)
PAIR PRODUCTION
Electron Pairs
Calculation of electron-pair creation cross sections on Sn and U, 14:32495 (RA;BR)
Photon Beams
Calculation of electron-pair creation cross sections on Sn and U, 14:32495 (RA;BR)
PALLADIUM
Catalytic Effects
Kinetics of CO oxidation on single-crystal Pd, Pt, and Ir, 14:31515 (J;US)
Chemisorption
Adsorbed layer and multilayer materials: The energetics and bonding of Pd and Ag on Nb(001) and Nb(110), 14:31258 (J;US)
Electronic Structure
Ten low-lying electronic states of Pd_3, 14:32513 (J;US)
Hydrogenation
X-ray-absorption study of the interaction of hydrogen with clusters of supported palladium, 14:31304 (J;US)
Phase Studies
Modulating the composition of a metal/oxide interface and using hydrogen as a probe, 14:31244 (J;US)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
Sorptive Properties
Rotationally inelastic scattering of N_2 from clean and hydrogen covered Pd(111), 14:32807 (J;US)
PALLADIUM ALLOYS
Fermi Level
Fermi-level tuning in $Y_{1-x}U_xPd_3$, 14:31265 (J;US)
Solution Heat
Alloy models with the embedded-atom method, 14:31257 (J;US)
PALLADIUM HYDRIDES
Lattice Parameters
X-ray-absorption study of the interaction of hydrogen with clusters of supported palladium, 14:31304 (J;US)
PAMELA PLANT
Design
Design experience of PAMELA, 14:30500 (RA;US)
Performance Testing
Vitrification of sodium-rich high-level waste, 14:30509 (RA;US)
PANCREAS
Digestive System Diseases
Contribution of computerized tomography to estimating severity of acute pancreatitis, 14:32253 (RA;DD;In German)
PAPER
Radiation Monitoring
25 years of reference measurements in the Karlsruhe whole-body counter: /sup 137/Cs in man, /sup 60/Co in steel, /sup 226/Ra and /sup 232/Th in paper, 14:32012 (RA;AT;In German)
Recycling
Recycling of secondary fibers by the Quebec paper industry, 14:31128 (R;CA;In French)
PAPER INDUSTRY
Air Pollution
PRENOX tests at recovery boiler 70 at Norrsundets Bruk. A study of NO/sub x/ emission in sodium nitrate additions, 14:31113 (R;SE;In Swedish)
Geothermal Process Heat
Industrial applications, 14:30782 (RA;US)
Waste Management
Recycling of secondary fibers by the Quebec paper industry, 14:31128 (R;CA;In French)
PARABANIC ACID
See ORGANIC OXYGEN COMPOUNDS
PARAFFINS
See ALKANES
PARALLEL PROCESSING
Beta operation: a parallel primitive. Doctoral thesis, 14:32977 (R;US)
Supercomputers for solving PDE problems. Final report, 1 October 1985-31 March 1988, 14:32980 (R;US)
Using control states for parallelism extraction. Final report, 1 March 1987-30 June 1988, 14:32979 (R;US)
Algorithms
A theoretical investigation of a parallel genetic algorithm, 14:32985 (R;US)
Domain decomposition algorithms and computational fluid dynamics, 14:32531 (J;US)
Parallel QR factorization algorithm using local pivoting, 14:32978 (R;US)

Computer Architecture
Architectural considerations, software support, and compiler issues in multi-computer implementation. Final report, 5 September 1985-31 October 1988, 14:32976 (R;US)
Programming Languages
QLISP for parallel processors. Final report, 15 July 1986-31 July 1988, 14:32974 (R;US)
PARAMAGNETIC RESONANCE (NUCLEAR)
See NUCLEAR MAGNETIC RESONANCE
PARASYMPATHETIC NERVOUS SYSTEM
See AUTONOMIC NERVOUS SYSTEM
PARTIAL DIFFERENTIAL EQUATIONS
See also BOLTZMANN EQUATION
BOLTZMANN-VLASOV EQUATION
MAXWELL EQUATIONS
NAVIER-STOKES EQUATIONS
Lagrangian Function
Grassmann-valued fluid dynamics, 14:32849 (J;US)
Numerical Solution
Convergence of a random particle method to solutions of the Kolmogorov equation $u_t=\nu u_{xx}+u(1-u)$, 14:33019 (J;US)
Convergence of a random walk method for the Burgers equation, 14:33018 (J;US)
PARTICLE BEAM FUSION ACCELERATOR
See also ELECTRON BEAM FUSION ACCELERATOR
Performance
Performance of the Hermes-III pulse forming lines, 14:31701 (R;US)
PARTICLE BOOSTERS
Apertures
Dynamic aperture of the ALS [Advanced Light Source] booster synchrotron, 14:31762 (R;US)
Beam Dynamics
Understanding and improving the high field orbit in the Fermilab Booster, 14:31715 (R;US)
PARTICLE DECAY
T Invariance
Search for violation of time reversal invariance in $K_{\mu 3}$ decays, 14:32545 (R;US)
PARTICLE INTERACTIONS
See also HADRON-HADRON INTERACTIONS
PHOTON-PHOTON INTERACTIONS
Spin
Comment on a paper by Rindani and Sivakumar, 14:32607 (J;US)
PARTICLE SIZE
Sorting
Real-time measurement of the size fractionation of aerosol black carbon during the Southern California Air Quality Study, June 13–September 4, 1987, Claremont College, California, 14:31932 (R;US)
PARTICLE TRACKS
Computerized Simulation
Triggering and data acquisition aspects of SSC tracking, 14:31855 (R;US)
PARTICLE-BEAM WEAPONS
See DIRECTED-ENERGY WEAPONS
PARTICLES
See also DROPLETS
PARTICULATES
Ionization
Micron-sized-particle impacts detected near Uranus by the Voyager 2 plasma-wave instrument. Progress report for period ending 1986, 14:32442 (R;US)
X-Ray Diffraction
A method for sizing sub-micron particles using small angle diffraction of soft x-rays, 14:32801 (R;US)
PARTICULATES
Air Pollution
Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri, 14:31960 (R;US)
Air Pollution Monitoring
Annual report on establishment and operation of the eastern fine-particle and visibility network, 14:31958 (R;US)
Compliance testing of Eielson Air Force Base Central Heating and Power Plant, coal-fired boiler number 3, Eielson Air Force Base, Alaska. Final report, 12-22 July 1988, 14:31988 (R;US)
Indoor Air Pollution
Health-hazard evaluation determination report No. 76-33-431, 76-34-431, Kaiser Aluminum and Chemical Corporation, Ravenswood, West Virginia, 14:31944 (R;US)
Health-hazard evaluation determination report No. 76-6-294, J. A. Devine, D.D.S., Cheyenne, Wyoming, 14:31963 (R;US)
Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana, 14:31947 (R;US)
Walk-through survey report, Central Brass Manufacturing Company, Cleveland, Ohio, March 20, 1987, 14:31956 (R;US)
Removal
1.0 Million Btu combustor testing: Test results: Part 2, 14:30803 (R;US)
Thermal Radiation
Analysis and in-cylinder measurement of particulate radiant emissions and temperature in a direct-injection diesel engine, 14:31156 (R;US)
PBFA
See PARTICLE BEAM FUSION ACCELERATOR
PBX DEVICES
Polarimetry
Measurement of the poloidal magnetic field in the PBX-M tokamak using the motional Stark effect, 14:32882 (R;US)
PCB
See CHLORINATED AROMATIC HYDROCARBONS
PEAT
Harvesting
Fuel peat in Newfoundland, 14:30280 (R;CA)
Reserves
Peatland inventory of Manitoba. 3. Interlake region using Landsat v thematic mapper, 14:30277 (R;CA)
PEATLANDS
See WETLANDS
PEBBLE BED REACTORS
Reactor Accidents
Fission product release profiles from spherical HTR fuel elements at accident temperatures, 14:30906 (R;DE)
PECULIAR A-STARS
See MAGNETIC STARS
PELLET INJECTION
Design
Tritium proof-of-principle injector experiment, 14:32948 (J;US)
PELLETRON ACCELERATORS
Electric Potential
Corona gradient distribution system variations and homogenization, 14:31691 (R;AU)
PELLETRONS
See PELLETRON ACCELERATORS
PELLETS (BREEDING)
See BREEDING PELLETS
PELLETS (FUEL)
See FUEL PELLETS
PELVIS
Computerized Tomography
Computed tomography and MRI of the female pelvis, 14:32293 (RA;DD)
Nmr Imaging
Computed tomography and MRI of the female pelvis, 14:32293 (RA;DD)
Magnetic resonance imaging in recurrent carcinoma of the pelvis and its differentation from fibrosis, 14:32295 (RA;DD)
PENTAMETHYLENEIMINES
See PIPERIDINES
PEOPLE
See HUMAN POPULATIONS
PEOPLES REPUBLIC OF CHINA
See CHINA

PEPTIDE HYDROLASES
Amino Acid Sequence
Reconstructing the evolution of vertebrate blood coagulation from a consideration of the amino acid sequences of clotting proteins, 14:32165 (BA;US)
Biological Evolution
Evolution of catalysis in the serine proteases, 14:32140 (BA;US)
Evolution of specificity and catalysis in subtilisin, 14:32144 (BA;US)
Metabolism
Phosphorus-containing peptide analogs as peptidase inhibitors, 14:32087 (BA;US)
Purification
Potential role of proteolysis in the control of UvrABC incision, 14:32201 (J;GB)
PEPTIDES
See also POLYPEPTIDES
Helical Configuration
C-peptide helix from ribonuclease A considered as an autonomous folding unit, 14:32116 (BA;US)
Mass Spectroscopy
Evaluation of pulsed fast-atom bombardment ionization for increased sensitivity of tandem mass spectrometry, 14:31401 (J;US)
Molecular Biology
Continuum electrostatics and hydration phenomena, 14:32186 (BA;US)
Proton Transport
Energy transformation in molecular electronic systems: Comprehensive progress report, 1986–1989, 14:31472 (R;US)
PERFORMANCE TESTING
Mathematical Models
Waste package performance assessment for the Yucca Mountain Project, 14:30613 (R;US)
Planning
Preliminary plan for disposal-system characterization and long-term performance evaluation of the Waste Isolation Pilot Plant, 14:30590 (R;US)
PERFUSED ORGANS
Nmr Spectra
NMR spectroscopy of the perfused rat liver: technical considerations, 14:32270 (RA;DD;In German)
PERHYDROXYL RADICAL
See HYDROPEROXY RADICALS
PERMEABILITY
Pressure Effects
Permeability of Ironton-Galesville sandstone at elevated temperature and pressure, 14:30941 (RA;CA;In English and French)
Temperature Effects
Permeability of Ironton-Galesville sandstone at elevated temperature and pressure, 14:30941 (RA;CA;In English and French)
PERMEABILITY COEFFICIENT (FLUID MECHANICS)
See HYDRAULIC CONDUCTIVITY
PERMUTIT (INORGANIC)
See INORGANIC ION EXCHANGERS
PERMUTIT (ORGANIC)
See ORGANIC ION EXCHANGERS
PEROXYACETYL NITRATE
Synthesis
Atmospheric chemistry of aldehydes: enhanced peroxyacetyl nitrate formation from ethanol-fueled vehicular emissions, 14:31978 (J;US)
PERSONAL COMPUTERS
Computer Networks
Evaluation of the IBM token-ring network via the proposed standard wiring plan, 14:33008 (R;US)
PERSONNEL
See also ASTRONAUTS
Lungs
Practical experience with dose measurements in uranium mines, 14:31828 (RA;AT;In German)
Occupational Exposure
Dosis loads for temporary workers in decontamination and radiation protection engaged in West German nuclear power plants, 14:30915 (RA;AT;In German)
Radiation Doses
The safety record at the tritium systems test assembly, 14:32936 (J;US)
Worldwide trends in occupational exposures at nuclear power plants, 14:30914 (RA;AT)
Radiation Protection
A new tritium facility - The Weapons Engineering Tritium Facility at Los Alamos National Laboratory, 14:32938 (J;US)
Practical experience with dose measurements in uranium mines, 14:31828 (RA;AT;In German)
Training
The dynamic duo: New technology and willing staff, 14:32966 (R;US)
PERSONNEL DOSIMETRY
Beta Dosimetry
Problems of personnel dose monitoring in mixed β-γ radiation fields caused by type licensing of thermoluminescent dosimeters, 14:31839 (RA;AT;In German)
Comparative Evaluations
1987 Neutron and gamma personnel dosimeter intercomparison study using a D_2O-moderated ^{252}Cf source, 14:31848 (R;US)
Gamma Dosimetry
Problems of personnel dose monitoring in mixed β-γ radiation fields caused by type licensing of thermoluminescent dosimeters, 14:31839 (RA;AT;In German)
German Democratic Republic
External occupational radiation exposure in the GDR in 1987, 14:32778 (R;DD;In German)
Historical Aspects
Quo vadis, personnel monitoring?, 14:32772 (RA;AT)
PERSONNEL FILM DOSIMETRY
See PERSONNEL DOSIMETRY
PERSONNEL MANAGEMENT
Human Factors
Applying understanding of individual behavior and team dynamics within the value engineering process, 14:32968 (R;US)
PERTECHNETATES
Quantitative Chemical Analysis
Stripping voltammetry of technetium(VII) by means of a glassy carbon electrode chemically modified with a TPAC loaded copolymer film, 14:31392 (R;DE;In German)
PERYLENE
Absorption Spectra
Molecular absorption measurements by FT/UV-Vis spectrometry, 14:31883 (J;US)
PETROCHEMICAL FEEDSTOCKS
See CHEMICAL FEEDSTOCKS
PETROCHEMICALS
PETROCHEMICAL PLANTS
Chemical Heat Pumps
Chemical heat pump study. Final report., 14:31129 (R;CA)
PETROCHEMICALS
See also PLASTICS
RESINS
Production
New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)
PETROLEUM
See also PETROLEUM FRACTIONS
Chemical Analysis
Analysis of heavy oils: Method development and application to Cerro Negro heavy petroleum: Detailed separation and analysis of basic compounds, 14:30312 (R;US)
Coprocessing
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987, 14:30255 (R;US)
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986, 14:30253 (R;US)
Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986, 14:30254 (R;US)

Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987, 14:30256 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988, 14:30258 (R;US)
Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987, 14:30257 (R;US)

Density
Modified corresponding states method for predicting densities of petroleum reservoir fluids, 14:30294 (J;US)

Desulfurization
Concentration and removal of nitrogen and sulfur containing compounds from organic liquids phases using electrochemically reversed chemical complexation, 14:30268 (J;US)

Econometrics
Changes in business-as-usual forecasts in a petroleum trade model, 14:30301 (J;GB)

Economics
Financial aspects of the consolidation of the US oil and gas industry in the 1980's, 14:30300 (R;US)

Enhanced Recovery
Contracts for field projects and supporting research on enhanced oil recovery: Progress review No. 55, quarter ending June 30, 1988, 14:30288 (R;US)
Improvement of CO_2 flood performance: Quarterly report, October–December 1988, 14:30291 (R;US)

Extraction
Oil velocities in the Weeks Island mine during oil recycle exercises, 14:30285 (R;US)

Forecasting
Changes in business-as-usual forecasts in a petroleum trade model, 14:30301 (J;GB)

Multi-Element Analysis
Neutron activation analysis possibilities for the elemental composition research in oil-shales, oil-bituminous rocks, petroleum and their fractions, 14:30379 (RA;CN)

Origin
Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)

Prices
Short-term energy outlook: Quarterly projections, April 1989, 14:30995 (R;US)

Storage
Technical safety appraisal of the strategic petroleum reserve, West Hackberry/Big Hill/New Orleans, 14:30299 (R;US)

Supply and Demand
Canadian energy supply and demand, 1987-2005. Summary, 14:30997 (R;CA;In French)

Trade
Changes in business-as-usual forecasts in a petroleum trade model, 14:30301 (J;GB)

PETROLEUM COKE
See COKE
PETROLEUM PRODUCTS

PETROLEUM DEPOSITS

Geology
Relationship between oil shales and low-matured heavy oil pools in Huanghua depression, 14:30332 (RA;CN)

PETROLEUM DISTILLATES
See also NAPHTHA

Supply and Demand
Short-term energy outlook: Quarterly projections, April 1989, 14:30995 (R;US)

PETROLEUM FRACTIONS
See also PETROLEUM DISTILLATES
PETROLEUM RESIDUES

Coprocessing
Upgrading of shale oil by an ebullated-bed reactor, 14:30364 (RA;CN)

PETROLEUM INDUSTRY

Financial Incentives
Petroleum Incentives Administration annual report, 1986, 14:31004 (R;CA)

Land Leasing
Manitoba surface rights board annual report, 1987-88, 14:30308 (R;CA)

Ownership
Petroleum Incentives Administration annual report, 1986, 14:31004 (R;CA)

Resistance Heating
Steam substitution in chemical process, petrochemical and petroleum industries, 14:31130 (R;CA)

Steam Systems
Steam substitution in chemical process, petrochemical and petroleum industries, 14:31130 (R;CA)

PETROLEUM PRODUCTS
See also DIESEL FUELS
GASOLINE
PETROCHEMICALS

Synthesis
Upgrading of shale oil by an ebullated-bed reactor, 14:30364 (RA;CN)

PETROLEUM REFINERIES

Air Pollution
Air quality survey in the vicinity of the Petro-Canada Trafalgar Refinery, Oakville, Ontario, 14:30305 (R;CA)

Catalytic Cracking
Corrosion problems in manufacturing liquid fuels in fluidized catalytic (FCC) installations, 14:30295 (R;GB)

Corrosion Protection
Corrosion problems in manufacturing liquid fuels in fluidized catalytic (FCC) installations, 14:30295 (R;GB)

PETROLEUM RESIDUES

Isotope Ratio
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 April–30 June 1986, 14:30253 (R;US)
Coal liquefaction process solvent characterization and evaluation: Second annual report, January 1–December 31, 1986, 14:30254 (R;US)

Structural Chemical Analysis
Coal liquefaction process solvent characterization and evaluation: Progress report, 1 January–31 March 1987, 14:30255 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1–March 31, 1988, 14:30258 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, January 1, 1986–March 31, 1986, 14:30252 (R;US)
Coal liquefaction process solvent characterization and evaluation: Technical progress report, July 1–September 30, 1987, 14:30256 (R;US)
Coal liquefaction process solvent characterization and evaluation: Third annual report, January 1–December 31, 1987, 14:30257 (R;US)

PETT
See POSITRON COMPUTED TOMOGRAPHY

PHAGES
See BACTERIOPHAGES

PHANTOMS

Nmr Spectra
Effect of substances shortening the relaxation time on /sup 31/P and /sup 13/C-NMR spectroscopy, 14:32269 (RA;DD;In German)

PHARMACEUTICALS
See DRUGS

PHARYNX

Computerized Tomography
CT in different types of tumors of the nasopharynx and of the paranasal sinuses, 14:32258 (RA;DD;In German)

PHENOL

Separation Processes
Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)

PHENOLS
See also PHENOL
Removal
Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
Yields
Design and testing of an autoclave system for lignin hydrotreating, 14:30737 (RA;US)
PHENOXY RADICALS
Electronic Structure
Resonance Raman studies of substituent effects on the electronic structure of phenoxyl radicals, 14:31513 (J;US)
PHI-1680 MESONS
Mass Spectra
Glueballs in 2^{++} $\phi\phi$ final states, 14:32550 (J;US)
PHI4-FIELD THEORY
Renormalization
Renormalization of the δ expansion of $\lambda(\phi^{2+2\delta})_2$ theory, 14:32639 (J;US)
PHILIPPINES
Aquifers
Use of isotope techniques to investigate saltwater intruded aquifers in the Philippines, 14:32062 (RA;XA)
Ground Water
Use of isotope techniques to investigate saltwater intruded aquifers in the Philippines, 14:32062 (RA;XA)
PHOSPHATE MINERALS
Agglomeration
Comparative study of chemical cold agglomeration between two Brazilian phosphate fines: Patos de Minas and Catalao-Go, Brazil, 14:31389 (R;BR;In Portuguese)
Fluorescence Spectroscopy
Comparative study of chemical cold agglomeration between two Brazilian phosphate fines: Patos de Minas and Catalao-Go, Brazil, 14:31389 (R;BR;In Portuguese)
X-Ray Diffraction
Comparative study of chemical cold agglomeration between two Brazilian phosphate fines: Patos de Minas and Catalao-Go, Brazil, 14:31389 (R;BR;In Portuguese)
PHOSPHATES
Quantity Ratio
Catalyst development for hydrodeoxygenation and dealkylation of lignins for fuels, 14:30735 (RA;US)
Structural Chemical Analysis
Pressure tuning of the electronic energy levels of ferrocene, cobaltocenium hexafluorophosphate, and nickelocene, 14:31504 (J;US)
PHOSPHINES
Radiolysis
Hydrolytic and radiolytic degradation of OϕD (iB)CMPO; continuing studies, 14:31571 (J;US)
Solvent Properties
Recovery of plutonium and americium from chloride salt wastes by solvent extraction, 14:30431 (J;US)
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
TRUEX process and the management of liquid TRU waste, 14:30619 (J;US)
Thermodynamic modeling of chemical equilibria in metal extraction, 14:31420 (J;US)
PHOSPHONATES
Uptake
Experimental study on the usefulness of magnetotherapy in bone fractures (tibial osteotomy in the rat). Accumulation of 99 mTc MDP - tests of tensile strength - determination of alkaline phosphatase, 14:32209 (R;DE;In German)
PHOSPHOPROTEINS
Biosynthesis
Switch from transcription to replication of a negative-strand RNA virus, 14:32113 (BA;US)
PHOSPHORIC ACID
Solvent Properties
Analysis of cobalt extraction by di-(2-ethylhexyl) phosphoric acid in a continuous flow stirred tank with a laser capillary spectrophotometer, 14:31421 (J;US)
Study of the INER process for uranium recovery from wet-process phosphoric acid, 14:30430 (J;US)
PHOSPHORS
See also GLASS SCINTILLATORS
Diffractometers
Performance of prototype position-sensitive neutron detectors on SXD at ISIS, 14:31850 (R;GB)
Neutron Detectors
Performance of prototype position-sensitive neutron detectors on SXD at ISIS, 14:31850 (R;GB)
PHOSPHORUS
Quaternary Alloy Systems
Contribution to the study of zinc and cadmium diffusions in InP and In/sub 0,97/ Ga/sub 0,03/ As/sub 0,08/ P/sub 0,92/ quaternary compound, 14:31199 (R;BR;In Portuguese)
PHOSPHORUS 37
Mass
Mass of /sup 37/P, 14:32662 (R;AU)
PHOSPHORUS COMPOUNDS
See also PHOSPHATES
PHOSPHINES
TUNGSTOPHOSPHATES
Isotachophoresis
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
Mass Spectroscopy
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
Passivation
An XPS study of the passivity of an amorphous Co-20P alloy, 14:31292 (BA;US)
PHOSPHORUS IONS
Recombination
Dielectronic recombination of P^{5+} and Cl^{7+} in configuration-average, *LS*-coupling, and intermediate-coupling approximations, 14:32527 (J;US)
PHOSPHORYLASES
See PHOSPHOTRANSFERASES
PHOSPHOTRANSFERASES
Structure-Activity Relationships
Structural and functional relationships in the adenylate kinase family, 14:32121 (BA;US)
PHOTOCATHODES
Beam Emittance
Requirements of high-surface electric fields for high-brightness FeI injectors, 14:31731 (R;FR)
Electron Beam Injection
Requirements of high-surface electric fields for high-brightness FeI injectors, 14:31731 (R;FR)
PHOTOCHEMICAL OXIDANTS
Air Pollution
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)
Global Aspects
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)
PHOTOCHEMICAL REACTIONS
See also PHOTOSYNTHESIS
Air Pollution
Validation testing of new mechanisms with outdoor chamber data. Volume 3: calculation of photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31941 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 4: appendixes to photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31942 (R;US)

Air Pollution Monitors
Validation testing of new mechanisms with outdoor chamber data, 14:31938 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 1: comparison of CB4 and CAL mechanisms. Final report, April 1986-September 1988, 14:31939 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)

PHOTODETECTORS
Quantum Efficiency
A fiber optic test system for quantum efficiency measurements, 14:31875 (R;US)

PHOTODISINTEGRATION
See PHOTONUCLEAR REACTIONS

PHOTOELECTROCHEMICAL CELLS
Electrodes
Photoelectrochemistry and photochemistry of sensitized semiconductor surfaces, 14:31293 (BA;US)

PHOTOELECTRON SPECTROSCOPY
Technology Assessment
Quantitation of Auger and X-ray photoelectron spectroscopies, 14:31464 (J;US)

PHOTOIONIZATION
Cross Sections
Photoabsorption and photoionization cross sections: an overview of the current state of knowledge, 14:32484 (R;US)
Photoionization cross sections of positive ions, 14:32485 (R;US)
Photoionization of Al^+ ions: a relativistic random phase approximation study, 14:32486 (R;US)

PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS

PHOTON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
PHOTONS

PHOTON BEAMS
Atoms
M-shell x-ray fluorescence cross section measurements for some elements with $72 \leq Z \leq 92$ at 5.96 KeV, 14:32494 (RA;BR)
Kev Range 01-10
M-shell x-ray fluorescence cross section measurements for some elements with $72 \leq Z \leq 92$ at 5.96 KeV, 14:32494 (RA;BR)
Pair Production
Calculation of electron-pair creation cross sections on Sn and U, 14:32495 (RA;BR)
Tin
Calculation of electron-pair creation cross sections on Sn and U, 14:32495 (RA;BR)
Uranium
Calculation of electron-pair creation cross sections on Sn and U, 14:32495 (RA;BR)

PHOTON DETECTION (GAMMA)
See GAMMA DETECTION

PHOTON TRANSPORT
Monte Carlo Method
Criticality benchmarks for COG: A new point-wise Monte Carlo code, 14:32754 (R;US)

PHOTON-ATOM COLLISIONS
Cross Sections
Photoabsorption and photoionization cross sections: an overview of the current state of knowledge, 14:32484 (R;US)

PHOTON-NUCLEON INTERACTIONS
Photoproduction
Observation of $\Sigma_c^0 \rightarrow \Lambda_c^+ \pi^-$ decays, 14:32572 (J;US)
Primakoff production of hybrid mesons, 14:32560 (J;US)

PHOTON-PHOTON INTERACTIONS
Annihilation
The reaction $\gamma\gamma \rightarrow \pi\pi$ at low energy, 14:32608 (J;US)
Particle Production
Resonance formation in photon-photon collisions, 14:32554 (J;US)
Two-photon formation of spin-one resonances and the nature of the *E*(1420), 14:32562 (J;US)
Vector-vector production in photon-photon interactions, 14:32563 (J;US)

PHOTONS
Accelerators
Photon accelerator, 14:31710 (J;US)
Particle Production
Search for the anomalous production of single photons in e^+e^- annihilation at $\sqrt{s}$ =29 GeV, 14:32577 (J;US)
Quark-Gluon Interactions
Polarized photons from quark-gluon plasma, 14:32587 (R;SU)

PHOTONUCLEAR REACTIONS
Isomer Ratio
Study on isomeric ratios in the /sup 45/Sc(γ,n)/sup 44mg/Sc and /sup 44/Ca(p,n)/sup 44mg/Sc reactions, 14:32666 (R;SU;In Russian)
Knock-Out Reactions
Measurement of $^{16}O(\gamma,n)^{15}O$ at medium energies, 14:32658 (J;US)
Photoproduction
Observation of $\Sigma_c^0 \rightarrow \Lambda_c^+ \pi^-$ decays, 14:32572 (J;US)
Primakoff production of hybrid mesons, 14:32560 (J;US)

PHOTOSYNTHESIS
Theory of photoinduced intramolecular electron transfer in condensed media, 14:30746 (J;US)
Biochemistry
Structural and evolutionary aspects of the key enzymes in photorespiration; RuBisCO and glycolate oxidase, 14:32126 (BA;US)

PHOTOSYNTHETIC REACTION CENTERS
Biophysics
Site-directed mutagenesis identifies a tyrosine radical involved in the photosynthesized oxygen-evolving system, 14:32196 (J;US)

PHOTOVOLTAIC CELLS
See also SOLAR CELLS
Research Programs
Photovoltaic Program Branch annual report, FY 1988, 14:30708 (R;US)

PHOTOVOLTAIC CONVERSION
Reviews
Department of Energy trip report: Review of the US photovoltaics industry conducted in November and December 1988, 14:30709 (R;US)
Technology Assessment
Department of Energy trip report: Review of the US photovoltaics industry conducted in November and December 1988, 14:30709 (R;US)

PHOTOVOLTAIC POWER SUPPLIES
P Codes
PVREG - A photovoltaic voltage regulation investigation tool: Program reference manual, 14:30748 (R;US)
PVREG – a photovoltaic voltage regulation investigation tool: PVREG user's manual, 14:30747 (R;US)
Stability
Islanding in dispersed, utility-interactive photovoltaic systems, 14:30749 (R;US)

PHTHALOCYANINES
Binding Energy
Electron donor-acceptor properties of porphyrins, phthalocyanines, and related ring chelates: a molecular orbit approach, 14:31540 (J;US)

PHYSICS
See also ATOMIC PHYSICS
HIGH ENERGY PHYSICS
NUCLEAR PHYSICS
Numerical Solution
Methods and programs for numerical solution of the mathematical physics problems. Scientific-technical collection, 14:32824 (R;SU;In Russian)
Research Programs
Physics Division progress report, October 1, 1986–September 30, 1987, 14:33025 (R;US)

PI-1016 RESONANCES
See MESONS

PIGE ANALYSIS
See PROTON REACTIONS
PIGMENT CELLS
See ANIMAL CELLS
PINS (FUEL)
See FUEL PINS
PION MINUS-DEUTERON INTERACTIONS
See PION-DEUTERON INTERACTIONS
PION MINUS-PROTON INTERACTIONS
Charge-Exchange Reactions
Mass dependent fits of the partial wave analysis of the $K^+\bar{K}0\pi-$ system, 14:32559 (J;US)
Particle Production
Glueballs in 2^{++} $\phi\phi$ final states, 14:32550 (J;US)
Hadroproduction of the iota meson observed in the $K_sK_s\pi^0$ final state, 14:32557 (J;US)
Search for A J^{PC} exotic hybrid meson, 14:32566 (J;US)
E/ι in hadroproduction, 14:32552 (J;US)
PION NEUTRAL-DEUTERON INTERACTIONS
See PION-DEUTERON INTERACTIONS
PION PLUS REACTIONS
Charge-Exchange Reactions
$^{14}C(\pi^+,\pi^-)^{14}O$ reaction between 19 and 80 MeV, 14:32657 (J;US)
PION PLUS-DEUTERON INTERACTIONS
See PION-DEUTERON INTERACTIONS
PION-DEUTERON INTERACTIONS
Particle Production
Inevitable dibaryons, 14:32599 (J;US)
PION-PION INTERACTIONS
The search for scalar mesons, 14:32553 (J;US)
PIONS
Particle Decay
Pion and muon decays beyond the standard model, 14:32589 (R;US)
Particle Production
Photon annd pion production in heavy ion collisions, 14:32740 (R;US)
PIPELINES
Corrosion
Microbial corrosion: 1988 workshop proceedings, 14:30865 (R;US)
Trace constituents in landfill gas. Task report on corrosion potential. Final report, May 1984-June 1985, 14:30652 (R;US)
Environmental Impacts
Environmental aspects of rights-of-way for natural gas transmission pipelines: An updated bibliography: Final report, September 1987–June 1988, 14:30321 (R;US)
Fluid Flow
Water hammer in piping. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:31656 (R;US)
Materials
Piping geothermal fluids, 14:30771 (RA;US)
Polyethylenes
Development of a magnetic coating for gas pipe detection. Final report, May 1987-June 1988, 14:30322 (R;US)
PIPERIDINES
Denitration
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
Removal
Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
PIPES
Cathodic Protection
The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel, 14:31236 (BA;US)
Fluid Flow
Water hammer in piping. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:31656 (R;US)
PITCH (REACTOR PARAMETERS)
See REACTOR LATTICE PARAMETERS
PITUITARY GLAND
Adenomas
Results of postoperative radiotherapy and radiation of recurrent tumours, observed in adenomas of the pituitary gland operated at a primary stage, 14:32344 (R;DE;In German)
PLANETARY ATMOSPHERES
Micron-sized-particle impacts detected near Uranus by the Voyager 2 plasma-wave instrument. Progress report for period ending 1986, 14:32442 (R;US)
PLANT CELLS
Origin
Origin of cells: a symbiosis between genes, catalysts, and membranes, 14:32159 (BA;US)
PLANT GROWTH
Spatial Distribution
Primary production, nutrients, and particulate matter in the southern California bight: Contributions to the C, N, and O_2 budgets: A component of the California Basin Study (CaBS): [Progress report, November 1988], 14:32438 (R;US)
PLANT TISSUES
Biodegradation
The role of proteolytic enzymes in degradation of plant tissues: Summary report, 14:30704 (R;US)
PLANTS (INDUSTRIAL)
See INDUSTRIAL PLANTS
PLANTS (POWER)
See POWER PLANTS
PLASMA
See also COLD PLASMA
COLLISIONLESS PLASMA
INHOMOGENEOUS PLASMA
LASER-PRODUCED PLASMA
QUIESCENT PLASMA
Ecr Heating
Uses of very high-power free-electron lasers based on electrostatic accelerators, 14:31648 (BA;US)
Electromagnetic Fields
Variation methods in the theory of the plasma bunches oscillations, 14:32878 (R;SU;In Russian)
Electromagnetic Radiation
Variation methods in the theory of the plasma bunches oscillations, 14:32878 (R;SU;In Russian)
Equilibrium
The Pierce diode with an external circuit. I. Oscillations about nonuniform equilibria, 14:32534 (J;US)
Fluctuations
Anomalous transport arising from nonlinear resistive pressure-driven modes in a plasma, 14:32891 (J;US)
Instability
The Pierce diode with an external circuit. II. Chaotic behavior, 14:32535 (J;US)
Ionosphere
Rocket-borne Langmuir probe response to an applied periodic potential, 14:31799 (RA;BR)
Langmuir Probe
Rocket-borne Langmuir probe response to an applied periodic potential, 14:31799 (RA;BR)
Meetings
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)
Parametric Instabilities
Time evolution from linear to nonlinear stages in magnetohydrodynamic parametric instabilities, 14:32465 (J;US)
Plasma Instability
Link between microstability and macrostability of plasmas, 14:32893 (J;US)
Scattering
Observation of parametric gain suppression in stimulated rotational Raman scattering over long air paths, 14:32887 (BA;US)
Technology Transfer
Proceedings of the 6. Japan-Brazil Symposium on Science and Technology, 14:32472 (R;BR)

Trajectories
Particle confinement in realistic 3D rotamak equilibria, 14:32892 (J;US)
Wave Propagation
Negative energy waves in magnetic flux tubes, 14:32876 (R;SU)
Photon accelerator, 14:31710 (J;US)

PLASMA (QUARK)
See QUARK MATTER

PLASMA ARC SPRAYING
Laser Radiation
Plasma initiated laser etching and deposition of semiconductor materials, 14:31343 (BA;US)

PLASMA CONFINEMENT
See also INERTIAL CONFINEMENT
Research Programs
Application of modern mathematical concepts to plasma confinement: Progress report, 14:32865 (R;US)

PLASMA DIAGNOSTICS
X-Ray Spectrometers
High-resolution bent-crystal spectrometer for the ultrasoft x-ray region, 14:32890 (J;US)

PLASMA DIODES
See THERMIONIC DIODES

PLASMA INSTABILITY
See also PLASMA MACROINSTABILITIES
PLASMA MICROINSTABILITIES
Waves and instabilities in noneutral plasmas, 14:32864 (R;US)

PLASMA MACROINSTABILITIES
Coupling
Link between microstability and macrostability of plasmas, 14:32893 (J;US)

PLASMA MICROINSTABILITIES
Link between microstability and macrostability of plasmas, 14:32893 (J;US)

PLASMA OSCILLATIONS
See PLASMA WAVES

PLASMA PRODUCTION
Energy Absorption
Measurement of electron energy deposition necessary to form an anode plasma in Ta, Ti, and C for coaxial bremsstrahlung diodes, 14:32888 (J;US)
Plasma Diagnostics
Tandem helium plasma spectrometry with a capacitively coupled discharge formed above a helium ICP, 14:32889 (J;US)

PLASMA SHEATH
Impurities
ICRF Faraday shield plasma sheath physics: The Perkins paradigm, 14:32901 (R;US)

PLASMA SWITCHES
Performance
Performance of the Hermes-III laser-triggered gas switches, 14:32931 (R;US)

PLASMA WAVES
Waves and instabilities in noneutral plasmas, 14:32864 (R;US)

PLASMONS
Dispersion Relations
Long-wavelength behaviour of charge-charge structure factor in insulating and metallic ground state of condensed hydrogen under pressure, 14:32803 (R;BR)
Excitation
Plasmon excitations in some II - VI and IV -VI semiconductors, 14:32794 (RA;BR)
Semiconductor Materials
Plasmon excitations in some II - VI and IV -VI semiconductors, 14:32794 (RA;BR)
Structure Factors
Long-wavelength behaviour of charge-charge structure factor in insulating and metallic ground state of condensed hydrogen under pressure, 14:32803 (R;BR)

PLASTIC PROPERTIES
See PLASTICITY

PLASTIC SCINTILLATION COUNTERS
See PLASTIC SCINTILLATION DETECTORS

PLASTIC SCINTILLATION DETECTORS
Design
Scintillating fiber detector development for the SSC: Annual progress report, 14:31810 (R;US)
Timing Properties
Fast trigger scintillator for the JETSET experiment (PS202/LEAR), 14:31817 (R;DE;In German)

PLASTICITY
Mathematical Models
Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking, 14:31216 (R;US)

PLASTICS
See also NYLON
POLYSTYRENE
POLYURETHANES
Quantitative Chemical Analysis
Transient infrared emission spectroscopy, 14:31407 (J;US)
Waste Disposal
Packaging-materials biodegradation. January 1973-April 1989 (Citations from the Rubber and Plastics Research Association data base). Report for January 1973-April 1989, 14:30982 (R;US)

PLASTICS INDUSTRY
Hazardous Materials
Health-hazard evaluation determination report No. 73-123-298, Campbell Plastics, Inc., Schenectady, New York, 14:31962 (R;US)
Industrial-hygiene survey report, P. D. George Company, St. Louis, Missouri, February 22-25, 1988, 14:31954 (R;US)
Industrial-hygiene survey report, Wabash Magnetic Company, Huntington, Indiana, May 24-26, 1988 (4,4'-methylenedianiline), 14:31955 (R;US)

PLATES
Crack Propagation
Ductile crack growth in nuclear austenitic stainless steel plates: influence of crack orientation and steel microstructure, 14:31205 (R;BR)
Fracture Properties
Ductile crack growth in nuclear austenitic stainless steel plates: influence of crack orientation and steel microstructure, 14:31205 (R;BR)

PLATINUM
Catalytic Effects
Infrared study of carbon on alumina, 14:31182 (R;US)
Kinetics of CO oxidation on single-crystal Pd, Pt, and Ir, 14:31515 (J;US)
Chemical Reactions
Probing metal cluster formation in NaY zeolite by ^{129}Xe NMR, 14:31508 (J;US)
Deactivation
Infrared study of carbon deposits on bimetallic catalysts: Final report, September 1, 1986--August 31, 1989, 14:31467 (R;US)
Fluorescence
Atomic fluorescence yields W/sub M4/, W/sub M5/, W/sub N4/ and W/sub N5/ of the elements Ir,Pt,Au,Th and U, 14:32497 (RA;BR)
Monocrystals
Metal/zirconia interfacial reactions in solid oxide fuel cell anodes, 14:31048 (BA;US)
Phase Studies
Metal/zirconia interfacial reactions in solid oxide fuel cell anodes, 14:31048 (BA;US)
Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)

PLATINUM 194
Coulomb Excitation
Coulomb excitation of the 4/sup +//sub 1/ states of /sup 194/Pt, /sup 196/Pt and /sup 198/Pt, 14:32677 (R;AU)

PLATINUM 196
Coulomb excitation of the 4/sup +//sub 1/ states of /sup 194/Pt, /sup 196/Pt and /sup 198/Pt, 14:32677 (R;AU)
PLATINUM 198
Coulomb excitation of the 4/sup +//sub 1/ states of /sup 194/Pt, /sup 196/Pt and /sup 198/Pt, 14:32677 (R;AU)
PLATINUM ALLOYS
See also PLATINUM BASE ALLOYS
Beta-Plus Decay
Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)
Catalytic Effects
Development of ternary alloy cathode catalysts for phosphoric acid fuel cells: Final report, 14:31043 (R;US)
Electron Capture Decay
Decay of /sup 183/Ir shape of /sup 183/Os and /sup 185/Pt in their low-spin states, 14:32669 (R;FR)
Magnetic Properties
Muon spin rotation in the magnetic and superconducting ground states of $(U,Th)Be_{13}$ and $(U,Th)Pt_3$, 14:31252 (J;US)
Solution Heat
Alloy models with the embedded-atom method, 14:31257 (J;US)
Superconductivity
Muon spin rotation in the magnetic and superconducting ground states of $(U,Th)Be_{13}$ and $(U,Th)Pt_3$, 14:31252 (J;US)
PLATINUM BASE ALLOYS
Catalytic Effects
Development of ternary alloy cathode catalysts for phosphoric acid fuel cells: Final report, 14:31043 (R;US)
PLATINUM COMPLEXES
Silicon
Microscopic models for (Au-Au) and (Pt-Pt) pair complexes in silicon, 14:32790 (RA;BR)
PLATINUM COMPOUNDS
Chemical Reactions
Guanidyl groups: new metal-binding ligands in biomolecules. Reactions of chloro(2,2':6',2"-terpyridine)platinum(II) with arginine in two cytochromes c and with other guanidyl ligands, 14:31505 (J;US)
PLESIOTHERAPY
See RADIOTHERAPY
PLT DEVICES
X-Ray Spectra
High-resolution bent-crystal spectrometer for the ultrasoft x-ray region, 14:32890 (J;US)
PLUGS
See CLOSURES
PLUMES
Complex Terrain
Project WIND, phase IV, dispersion study. Aerial smoke plume observations and surface layer turbulence measurements. Part 1, 14:31909 (R;DK)
Computerized Simulation
Monitoring of hot water plume movements in an aquifer with borhole/surface resistivity measurements, 14:30764 (RA;CA;In English and French)
Evaluation
Improvements in efficiency, capacity, and reliability of Mound's effluent removal system, 14:32951 (J;US)
Thermal Diffusion
Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)
PLUTONIUM
Dissolution
Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid, 14:30447 (J;US)
Impurities
The determination of impurities in plutonium metal by anion exchange and ICP/AES, 14:31242 (J;US)
Isotope Ratio
High precision isotopic analyses of uranium and plutonium by total sample volatilization and signal integration, 14:31473 (R;US)
Materials Recovery
Development and active demonstration of acid digestion of plutonium-bearing waste, 14:30483 (RA;US)
On-Line Measurement Systems
Last improvements of the DTC 1000 spectrophotometer, 14:30437 (R;FR;In French)
Phase Studies
Effect of uranium on third phase formation in the Pu(IV)-HNO_3-TBP-dodecane system, 14:30445 (J;US)
Quantitative Chemical Analysis
Simultaneous estimation of Pu and fission products by gamma spectrometry, 14:31383 (R;IN)
Remote Handling
Remote handling and size reduction of solid alpha-active waste, 14:30494 (RA;US)
Solvent Extraction
Recovery of plutonium and americium from chloride salt wastes by solvent extraction, 14:30431 (J;US)
Transport
An analysis of the background and development of regulations for the air transport of plutonium in the USA, 14:30596 (R;US)
Design aspects of plutonium air-transportable packages, 14:30600 (R;US)
PLUTONIUM 238
Radionuclide Kinetics
United States transuranium registry: Annual report, 1 October 1987–30 September 1988, 14:32372 (R;US)
PLUTONIUM 239
Neutron Spectra
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Radionuclide Kinetics
United States transuranium registry: Annual report, 1 October 1987–30 September 1988, 14:32372 (R;US)
Scintillation Counting
Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent extraction-liquid scintillation count method, 14:31805 (R;CN;In Chinese)
Solvent Extraction
Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent extraction-liquid scintillation count method, 14:31805 (R;CN;In Chinese)
PLUTONIUM FLUORIDES
Binding Energy
4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
PLUTONIUM ISOTOPES
See also PLUTONIUM 238
PLUTONIUM 239
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
PLUTONIUM NITRATES
Criticality
Criticality experiments with a mixed oxide fuel pin array in plutonium-uranium nitrate solutions, 14:30440 (R;US)
PLUTONIUM OXIDES
Binding Energy
4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
PNA
See POLYCYCLIC AROMATIC HYDROCARBONS
PNEUMONITIS
Radioinduction
Inhaled ^{147}Pm and/or total-body gamma radiation: Early mortality and morbidity in rats, 14:32376 (R;US)

PNL
See BATTELLE PACIFIC NORTHWEST LABORATORIES
POINT DEFECTS
See also INTERSTITIALS
Grain Boundaries
Grain boundary strength as point defect sink strength, 14:31211 (RA;SU;In Russian)
Physical Radiation Effects
Grain boundary strength as point defect sink strength, 14:31211 (RA;SU;In Russian)
POISONS (CHEMICAL)
See HAZARDOUS MATERIALS
POLARIMETERS
Design
LEP and CEBAF polarimeters: Revision, 14:31734 (R;US)
POLIO VIRUS
Molecular Biology
Molecular events leading to poliovirus genome replication, 14:32110 (BA;US)
Mutants
Construction of a mutagenesis cartridge for poliovirus genome-linked viral protein: isolation and characterization of viable and nonviable mutants, 14:32197 (J;US)
POLLUTANTS
Analytical procedures for environmental quality control. Volume 1. Technical report, 14:32041 (R;US)
Chemical Analysis
Analytical procedures for environmental quality control. Volume 2. Technical report, 14:32042 (R;US)
Analytical procedures for environmental quality control. Volume 3. Technical report, 14:32043 (R;US)
Emission
The role of regional activity forecasts in projecting emission trends of acid deposition precursors, 14:31918 (R;US)
X-Ray Fluorescence Analysis
Sequential determination of biological and pollutant elements in marine bivalves, 14:31460 (J;US)
POLLUTION CONTROL EQUIPMENT
See also BAGHOUSES
CATALYTIC CONVERTERS
ELECTROSTATIC PRECIPITATORS
EXHAUST RECIRCULATION SYSTEMS
INERTIAL SEPARATORS
Barrierless ultrasonic air cleaner. Final report, 14:31913 (R;US)
POLLUTION SOURCES
Emission
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)
Global Aspects
Photochemical oxidant episodes, acid deposition and global atmospheric change. The relationships with emission changes of nitrogen oxides and volatile organic compounds, 14:31908 (R;NO)
POLOIDAL DIVERTORS
See POLOIDAL FIELD DIVERTORS
POLOIDAL FIELD DIVERTORS
Measuring Methods
Measurement of the poloidal magnetic field in the PBX-M tokamak using the motional Stark effect, 14:32882 (R;US)
POLONIUM 218
Recombination
The study of neutralization of Po-218 ions by small ion recombination in O_2, Ar and N_2, 14:31061 (R;US)
POLY(ISOBUTYLENE OXIDE)
See ORGANIC POLYMERS
POLYACRYLONITRILE
See NITRILES
ORGANIC POLYMERS
POLYAMIDES
See also NYLON
POLYURETHANES
Sorptive Properties
Uranium recovery from seawater by adsorption, 14:31446 (J;US)
POLYCYCLIC AROMATIC AMINES
Indoor Air Pollution
Industrial-hygiene survey report, P. D. George Company, St. Louis, Missouri, February 22-25, 1988, 14:31954 (R;US)
Industrial-hygiene survey report, Wabash Magnetic Company, Huntington, Indiana, May 24-26, 1988 (4,4'-methylenedianiline), 14:31955 (R;US)
POLYCYCLIC AROMATIC HYDROCARBONS
Air Pollution
Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri, 14:31960 (R;US)
Biological Effects
Fate and effects of PAHs in the terrestrial environment: An overview, 14:31995 (R;US)
Chemical Properties
Chemical data for predictinng the fate of organic compounds in water: Volume 1, Technical basis: Final report, 14:32035 (R;US)
Fluorescence Spectroscopy
Fluorescence line narrowing spectrometry of nucleoside-polycyclic aromatic hydrocarbon adducts on thin-layer chromatographic plates, 14:31458 (J;US)
Nitration
Nitration of acephenanthrylene under simulated atmospheric conditions in solution and the presence of nitroacephenanthrylene(s) in ambient particles, 14:31979 (J;US)
Surface Properties
Organized monolayers of polycyclic aromatic quinones, 14:31509 (J;US)
POLYETHERS
See POLYETHYLENE GLYCOLS
POLYETHYLENE GLYCOLS
Solvent Properties
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)
Synergistic solvent extraction of manganese by macrocyclic crown ethers in combination with didodecylnaphthalene sulfonic acid: effect of macrocycle substituents, 14:31416 (J;US)
POLYETHYLENE OXIDES
See POLYETHYLENE GLYCOLS
POLYETHYLENES
Coatings
Development of a magnetic coating for gas pipe detection. Final report, May 1987-June 1988, 14:30322 (R;US)
Extrusion
A process for solidifying sodium nitrate waste in polyethylene, 14:30454 (R;US)
Performance Testing
Development and evaluation of polyethylene as solidification agent for low-level waste, 14:30480 (RA;US)
Pipe Joints
Quality demands and methods of control in the case of welded plastic-casing pipe joints. Part 1, 14:31334 (R;DK;In Danish)
POLYMERIZATION
Radioinduction
Radiation-induced polymerization of cyclophosphazene trimers. Final report, 1 September 1985-30 September 1988, 14:31568 (R;US)
POLYMERS
See also ELASTOMERS
ORGANIC POLYMERS
SILICONES
Physical Properties
Liner-waste compatibility studies for coal-fired power plants, 14:31112 (R;US)
Solubility
Improvement of CO_2 flood performance: Quarterly report, October–December 1988, 14:30291 (R;US)

Sorptive Properties
Acid recovery of polyamine, 14:30661 (RA;US)
Triple Point
FTHETA point exponents of polymers in $d=2$, 14:31362 (J;US)
POLYNUCLEAR AROMATIC HYDROCARBONS
See POLYCYCLIC AROMATIC HYDROCARBONS
POLYPEPTIDES
Energy Transfer
Free energy (chemomechanical) transduction in elastomeric polypeptides by chemical potential modulation of an inverse temperature transition, 14:32192 (BA;US)
Molecular Structure
Chain build-up procedure in computing the structures of biologically active polypeptides and proteins, 14:31977 (BA;US)
POLYSACCHARIDES
See also CELLULOSE
LIGNIN
Enzymatic Hydrolysis
Mechanisms of plant cell wall resistance to polysaccharide degrading enzymes: a study using nuclear magnetic resonance analysis, 14:30730 (RA;US)
Mass Spectra
Use of various ionization modes for the study of molecules of biological interest, 14:31384 (R;FR;In French)
POLYSTYRENE
Chemical Properties
Theoretical interpretation of the anomalous behavior of some macromolecules, 14:31477 (BA;US)
Compressibility
Filtration behavior of slurries with varying compressibilities, 14:31456 (J;US)
Fractionation
Separation and characterization of colloidal materials of variable particle size and composition by coupled column sedimentation field-flow fractionation, 14:31410 (J;US)
Sedimentation
Separation and characterization of colloidal materials of variable particle size and composition by coupled column sedimentation field-flow fractionation, 14:31410 (J;US)
POLYSTYRENE-DVB
Efficiency
Separation of nitrogen isotopes by displacement band chromatography, 14:31491 (J;US)
POLYSULFIDES
See SULFIDES
POLYTETRAOXANE
See ORGANIC POLYMERS
POLYTHENE
See POLYETHYLENES
POLYTHIONATES
See OXYGEN COMPOUNDS
SULFUR COMPOUNDS
POLYTHIONIC ACIDS
See OXYGEN COMPOUNDS
SULFUR COMPOUNDS
POLYURETHANES
Adhesion
Adhesion between polyurethane insulation and media tubes, 14:31144 (R;DK;In Danish)
POLYVINYL CHLORIDE
See PVC
PONDS
Heat Losses
Aquaculture, 14:30781 (RA;US)
POOLS
See PONDS
POOR PEOPLE
See LOW INCOME GROUPS
POPULATION DYNAMICS
M Codes
MOCPOP: a flexible simulator for analysis of age-structured population and stock-related functions, 14:30697 (RA;US)
POPULATIONS
See also HUMAN POPULATIONS
Comparative Evaluations
Evaluation of stream biological communities in nonthermal reaches of Four Mile Creek: Revision 1, 14:32052 (R;US)
PORPHYRINS
See also CHLOROPHYLL
HEMOGLOBIN
MYOGLOBIN
Binding Energy
Electron donor-acceptor properties of porphyrins, phthalocyanines, and related ring chelates: a molecular orbit approach, 14:31540 (J;US)
Electron Transfer
Effect of triplet spin dynamics memory in electron-transfer reactions. Fourier transform-electron paramagnetic resonance spectroscopy, 14:31565 (J;US)
Mass Spectra
Use of various ionization modes for the study of molecules of biological interest, 14:31384 (R;FR;In French)
Photochemical Reactions
Polyelectrolyte-stabilized metal oxide hydrosols as catalysts for the photooxidation of water by zinc porphyrins, 14:31558 (J;US)
Raman Spectra
Effects of solvents, axial ligation, and radical cation formation on the V=O stretching Raman frequency in vanadyl porphyrins: implications for peroxidase intermediates, 14:31498 (J;US)
Structural Chemical Analysis
Electrochemical and Raman characterization of molecular recognition sites in self-assembled monolayers, 14:31520 (J;US)
Oxomanganese(IV) porphyrins identified by resonance Raman and infrared spectroscopy: weak bonds and the stability of the half-filled t_{2g} subshell, 14:31499 (J;US)
PORTLAND CEMENT
Mechanical Properties
Properties of shale ash (taken from the boiling furnace) Portland cement, 14:30405 (RA;CN)
Waste Product Utilization
Investigation on the Portland pozzolana cement with more shale ash content, 14:30406 (RA;CN)
Multipurpose use of shale ash and its paragenetic mineral in China, 14:30404 (RA;CN)
Properties of shale ash (taken from the boiling furnace) Portland cement, 14:30405 (RA;CN)
PORTS
See HARBORS
POSITION SENSITIVE DETECTORS
X-Ray Diffraction
Operating instructions for the collection and analysis of x-ray diffraction data using a position sensitive detector system, 14:32782 (R;GB)
POSITIVE IONS
See CATIONS
POSITRON BEAMS
Beam-Beam Interactions
Observation of beam-beam deflections at the interaction point of the SLAC Linear Collider, 14:31730 (J;US)
POSITRON COMPUTED TOMOGRAPHY
Diagnostic Uses
Positron emission computed tomography, 14:32354 (BA;US)
Technology Assessment
Positron emission computed tomography, 14:32354 (BA;US)
POSITRON DECAY
See BETA-PLUS DECAY
POSITRON SOURCES
Design
High-yield positron systems for linear colliders, 14:31769 (R;US)
POST-IRRADIATION EXAMINATION
Destructive Testing
EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)
Inspection
EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)

POSTULATED PARTICLES
See also GLUONS
HEAVY LEPTONS
HIGGS BOSONS
MAGNETIC MONOPOLES
QUARKS
TOP PARTICLES

Physical Properties
Search for A J^{PC} exotic hybrid meson, 14:32566 (J;US)

POTABLE WATER
See DRINKING WATER

POTASSIUM
Bragg Reflection
X-ray determination of the modulation potential in a stage-2 potassium-graphite intercalation compound, 14:31363 (J;US)

Isotope Dating
Pre-cambrian geochronology in Rio Grande do Norte, Brazil, 14:32416 (R;BR;In Portuguese)

Photoionization
Photoionization cross sections of positive ions, 14:32485 (R;US)

POTASSIUM BROMIDES
Chemical Analysis
Anomalous dispersion effects in diffuse reflectance infrared fourier transform spectroscopy: A study of optical geometries, 14:31882 (J;US)

POTASSIUM CHLORIDES
Deformation
Thermal conductivity of deformed potassium chloride, 14:31380 (J;US)

Molecular Beam Epitaxy
Growth of alkali halides from molecular beams: Global growth characteristics, 14:31360 (J;US)

POTASSIUM COMPOUNDS
See also POTASSIUM BROMIDES
POTASSIUM CHLORIDES
POTASSIUM HYDROXIDES
POTASSIUM OXIDES

Crystal Field
Crystal-field splitting of core excitons in ionic crystals, 14:31367 (J;US)

Ion Exchange
Multicomponent fixed-bed ion exchange: verification of equilibrium coherence theory, 14:31442 (J;US)

Separation Processes
Proton-ionizable crown compounds: transport of alkali and alkaline earth cations using proton-ionizable triazolo macrocycles, 14:31439 (J;US)

POTASSIUM HYDROXIDES
Photochemical Reactions
Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces, 14:31524 (J;US)

POTASSIUM IONS
Photoionization
Photoionization cross sections of positive ions, 14:32485 (R;US)

POTASSIUM OXIDES
Phonons
High-energy oxygen phonon modes and superconductivity in $Ba_{1-x}K_xBiO_3$: An inelastic-neutron-scattering experiment and molecular-dynamics simulation, 14:31302 (J;US)

POTENTIAL FLOW
Numerical Solution
Coupling of the boundary element method with an integral momentum boundary-layer technique to calculate forces and moments on three-dimensional bodies, 14:31603 (R;US)

POWER DEMAND
Audits
Demand-side management audit: improving the estimates of DSM impacts, 14:31016 (RA;US)

Forecasting
Forecasting and validating participation rates over time, 14:31015 (RA;US)

Planning
Demand-side management strategies for the 90s: Proceedings: Fourth national conference on utility DSM programs: Volume 1, 14:31007 (R;US)
Integrated resource planning: who's going to do it?, 14:31025 (RA;US)

Program Management
End-use evaluation, 14:31021 (RA;US)
Why utilities should promote DSM while choking on capacity surplus, 14:31012 (RA;US)

POWER PLANTS
See also DUAL-PURPOSE POWER PLANTS
HYDROELECTRIC POWER PLANTS
THERMAL POWER PLANTS
THERMONUCLEAR POWER PLANTS

Cost
Benefits and costs of small, short-lead-time power plants and demand-site programs in an era of load-growth uncertainty, 14:30797 (R;US)

Operating Cost
Historical plant cost and annual production expenses for selected electric plants 1987, 14:30792 (R;US)

Production
Historical plant cost and annual production expenses for selected electric plants 1987, 14:30792 (R;US)

POWER POOLS
See INTERCONNECTED POWER SYSTEMS

POWER REACTORS
See also ANGRA-1 REACTOR
CATAWBA-2 REACTOR
CHERNOBYLSK-4 REACTOR
GUNDREMMINGEN-2 REACTOR
GUNDREMMINGEN-3 REACTOR
KRSKO REACTOR
OKG-2 REACTOR
OBRIGHEIM REACTOR
RWE-BAYERNWERK REACTOR
SEABROOK-1 REACTOR
SEABROOK-2 REACTOR
TROJAN REACTOR
ZION-1 REACTOR
ZION-2 REACTOR

Electrical Equipment
Expert systems for analysis and management assistance of nuclear reactor electrical power supplies, 14:30863 (R;FR)

POWER SUPPLIES
See also PHOTOVOLTAIC POWER SUPPLIES

Comparative Evaluations
New energy replacement method for resonant power supplies, 14:31755 (R;US)

Design
Tuning magnet power supply, 14:31754 (R;US)

Linear Accelerators
Ferrito isolator for RF power supply system of a linear accelerator, 14:31745 (RA;SU;In Russian)

Optimization
Optimization of Resonant Power Supply Circuit, 14:31753 (R;US)

POWER SYSTEMS
See also INTERCONNECTED POWER SYSTEMS

Optimization
Power plant performance monitoring and improvement: Volume 6, Economic dispatch optimization, 14:30794 (R;US)

POWER TRANSMISSION LINES
Electrical Faults
Fault Location in the Finnish transmission network, 14:30813 (R;FI;In Finnish)

Health Hazards
Occupational safety and health effects of high-voltage transmission lines, 14:32405 (R;US)

Line Losses
Study of effective aeolian wind power imparted to single conductor spans, 14:30812 (R;CA)

Occupational Safety
Occupational safety and health effects of high-voltage transmission lines, 14:32405 (R;US)
Wind Loads
Aeolian vibration excitation of bundle conductors. Vol. 1 and 2, 14:30815 (R;CA)
Study of effective aeolian wind power imparted to single conductor spans, 14:30812 (R;CA)

POWER TRANSMISSION TOWERS
Health Hazards
The electrical characteristics of wood poles, 14:32404 (R;CA)

PRASEODYMIUM
Energy-Level Transitions
High energy magnetic inelastic neutron scattering at ISIS, 14:32752 (R;GB)
Multiplets
High energy magnetic inelastic neutron scattering at ISIS, 14:32752 (R;GB)

PRASEODYMIUM OXIDES
Physical Properties
Preparation and Raman analysis of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$, 14:31312 (J;US)

PRECIPITATION
Forecasting
The effect of precipitation on contaminant dissolution and transport: Analytic solutions, 14:30567 (R;US)

PRECIPITATIONS (ATMOSPHERIC)
See ATMOSPHERIC PRECIPITATIONS

PREDATOR-PREY INTERACTIONS
Feasibility Studies
Feasibility of reducing or controlling predation induced mortality of juvenile salmonids in Columbia River reservoirs, 14:30684 (RA;US)
Mathematical Models
Population dynamics of northern squawfish and potential predation on juvenile salmonids in a Columbia River reservoir, 14:30688 (RA;US)
Simulation of predation by a resident fish on juvenile salmonids in a Columbia River Reservoir, 14:30690 (RA;US)
R Codes
User's guide for RESPRED: a model of predation by resident fish on juvenile salmonids in a Columbia River reservoir, 14:30698 (RA;US)

PRESSES
Technology Assessment
Mobile supercompaction service for DAW, 14:30478 (RA;US)

PRESSURE MEASUREMENT
Calibration Standards
Extended x-ray-absorption fine-structure study of copper under high pressure, 14:31256 (J;US)

PRESSURE VESSELS
Surface Cleaning
Wall conditioning in ATF [Advanced Toroidal Facility], 14:32899 (R;US)

PRESSURIZED WATER COOLED MODERATED REACTOR
See PWR TYPE REACTORS

PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS

PRESTRESSED CONCRETE
Stress Analysis
Stress analysis and review of a prestressed concrete reactor pressure vessel of a HTR 500-type, 14:31323 (R;DE)

PRIMATES
See also MAN
Biological Evolution
Reconstruction of phylogenetic trees and estimation of divergence times under estimation of evolution, 14:32162 (BA;US)

PRINCETON LARGE TORUS
See PLT DEVICES

PRINTING AND PUBLISHING INDUSTRY
Hazardous Materials
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Heat Recovery
Case-Hoyt/Rochester Corporation printing waste heat recovery project. Final report, 14:31125 (R;US)

PROBES
Corrections
Correcting the error in neutron moisture probe measurements caused by a water density gradient, 14:31990 (R;AU)
Design
Preliminary assessment of an inflatable inspection probe: Phases 1 and 2, 14:30866 (R;US)

PROCESS CONTROL
Fiber Optics
Fiber optic sensing for NDE and process control, 14:31110 (R;US)

PROCESSING (DATA)
See DATA PROCESSING

PROCESSING (ORES)
See ORE PROCESSING

PROCESSING (WASTES)
See WASTE PROCESSING

PRODUCTION (HYDROGEN)
See HYDROGEN PRODUCTION

PRODUCTION (PAIR)
See PAIR PRODUCTION

PRODUCTION (PLASMA)
See PLASMA PRODUCTION

PRODUCTION CAPACITY
See CAPACITY

PROGRAM MANAGEMENT
Economics
Learning the value of VE, 14:32973 (R;US)
Evaluation
Evaluation of DOE's Partnership in Low-Income Residential Retrofit (PILIRR) Program, 14:31075 (R;US)
Planning
Systems approach to project management, 14:32965 (R;US)

PROGRAMMING
See also DATA-FLOW PROCESSING
PARALLEL PROCESSING
VECTOR PROCESSING
Automation
Beta operation: a parallel primitive. Doctoral thesis, 14:32977 (R;US)
Optimization
Source-level transformations for multiple specialization of horn clauses, 14:32984 (R;US)

PROGRAMMING LANGUAGES
See also FORTRAN
QLISP for parallel processors. Final report, 15 July 1986-31 July 1988, 14:32974 (R;US)
Design
A simple method to remove reference counting in applicative programs, 14:33012 (R;US)

PROGRESS REPORT
Ganil Cyclotron
Activity report, 14:32650 (R;FR;In French)
Saclay Linac
Activity report, 14:32650 (R;FR;In French)
Saturne
Activity report, 14:32650 (R;FR;In French)

PROJECT MANAGEMENT
See PROGRAM MANAGEMENT

PROJECTILES
Impact Tests
Capabilities and some applications of the LLNL 100-kV electric gun, 14:31623 (R;US)

PROMETHIUM
Solvent Extraction
Synergistic extraction of trivalent actinides and lanthanides using HTTA and an AZA-crown ether, 14:31418 (J;US)

PROMPT NEUTRONS
Energy Dependence
Evaluation of the energy dependence of the average number of prompt neutrons 4u-bar p for neutron-induced fission of /sup 235/U in the 0-20 MeV energy range, 14:32685 (RA;XA)

PRONGS
See PARTICLE TRACKS
PROPANE
Critical Pressure
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
Critical Temperature
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
Hydroxylation
Biomimetic catalysis: Hydroxylation of C_2, C_3, and cycloC_6 hydrocarbons by managanese porphyrin and non-porphyrin catalysts in the presence of monooxygen transfer reagents, 14:30706 (R;US)
Solvent Properties
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
1,2,3-PROPANETRIOL
See GLYCEROL
1-PROPANOL
See PROPANOLS
2-PROPANOL
See PROPANOLS
PROPANOLS
Indoor Air Pollution
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Solvent Extraction
Performance of spray, sieve tray, and packed contactors for high pressure extraction, 14:31453 (J;US)
PROPANONE
See ACETONE
PROPELLANTS
Combustion
Modeling thermal-mechanical processes associated with the initiation and combustion of granular energetic materials, 14:31583 (R;US)
Fragmentation
Characterization of booster-rocket propellants and their simulants, 14:31895 (R;US)
PROPENE
See PROPYLENE
PROPORTIONAL COUNTERS
See also MULTIWIRE PROPORTIONAL CHAMBERS
Design
The Argonne low level ^{14}C counting system, 14:31905 (R;US)
Fission Fragment Detection
Notes on the theory of parallel plate avalanche detectors, 14:31812 (R;US)
Plutonium
25 years of in vivo measurements of transuranes at KFK, 14:31844 (RA;AT;In German)
PROPULSION SYSTEMS
Electrochemical Cells
ANL electrochemical program for DOE/EHP: Quarterly technical progress report for April through June 1988, 14:30961 (R;US)
PROPYL ALCOHOLS
See PROPANOLS
PROPYLENE
Oxidation
Studies on a membrane reactor, 14:31490 (J;US)
Reduction
Studies on a membrane reactor, 14:31490 (J;US)
PROSTAGLANDINS
Molecular Structure
Electrostatic interactions and conformation of some thromboxane antagonists, 14:32182 (BA;US)
PROSTATE
Carcinomas
Staging of prostatic cancer by NMR imaging, 14:32294 (RA;DD;In German)
Nmr Imaging
Staging of prostatic cancer by NMR imaging, 14:32294 (RA;DD;In German)
PROTACTINIUM ISOTOPES
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
PROTECTION (RADIATION)
See RADIATION PROTECTION
PROTECTIVE CLOTHING
Chemical and biological warfare: protection, decontamination, and disposal. January 1979-April 1989 (Citations from the NTIS data base). Report for January 1979-April 1989, 14:31601 (R;US)
PROTECTIVE COATINGS
Heat Resistant Materials
Thermal-barrier coatings: coating methods, performance, and heat-engine applications. July 1982-April 1989 (Citations from the EI Engineering Meetings data base). Report for July 1982-April 1989, 14:31222 (R;US)
PROTEIN SEQUENCING
See AMINO ACID SEQUENCE
PROTEIN STRUCTURE
Labelling
Role of acyl carrier protein isoforms in plant lipid metabolism: Progress report, 14:32173 (R;US)
PROTEINS
See also ALBUMINS
CYTOCHROMES
GLOBIN
MEMBRANE PROTEINS
NUCLEOPROTEINS
PEPTIDES
PHOSPHOPROTEINS
THYLAKOID MEMBRANE PROTEINS
Amino Acid Sequence
Construction of a mutagenesis cartridge for poliovirus genome-linked viral protein: isolation and characterization of viable and nonviable mutants, 14:32197 (J;US)
Involvement of cryptic ATPase activity of UvrB and its proteolysis product, UvrB* in DNA repair, 14:32202 (J;GB)
Biological Evolution
β Turns in early evolution: chirality, genetic code, and biosynthetic pathways, 14:32118 (BA;US)
Evolution of protein structures, 14:32117 (BA;US)
Evolution of the genetic apparatus: a review, 14:32079 (BA;US)
Gene duplication and the origin of repetitive protein structures, 14:32119 (BA;US)
Sequence convergence and functional adaptation of stomach lysozymes from foregut fermenters, 14:32167 (BA;US)
Biological Functions
Evolution of catalytic function, 14:32078 (BA;US)
Role of RNA and protein in ribosome function: a review of early reconstitution studies and prospects for future studies, 14:32145 (BA;US)
Biosynthesis
Approaches to the determination of the three-dimensional architecture of ribosomal particles, 14:32152 (BA;US)
Evolution of anticodons: variations in the genetic code, 14:32156 (BA;US)
Evolving ribosome structure and function: rRNA and the translation mechanism, 14:32147 (BA;US)
Kinetic devices in protein synthesis, DNA replication, and mismatch repair, 14:32143 (BA;US)
Modus operandi of the ribosome, 14:32151 (BA;US)
Origin of cells: a symbiosis between genes, catalysts, and membranes, 14:32159 (BA;US)
Peptide-specific ribosomes, genomic tags, and the origin of the genetic code, 14:32153 (BA;US)

Phylogeny of tRNA sequences provides evidence for ambiguity reduction in the origin of the genetic code, 14:32155 (BA;US)

Electron Transfer
Theory of photoinduced intramolecular electron transfer in condensed media, 14:30746 (J;US)

Mass Spectra
Use of various ionization modes for the study of molecules of biological interest, 14:31384 (R;FR;In French)

Molecular Biology
Approximation of the Planck-Benzinger thermal work function in protein refolding in ribonuclease systems, 14:32193 (BA;US)

Molecular Structure
Calcium coordination and the calmodulin fold: divergent versus convergent evolution, 14:32127 (BA;US)
Chain build-up procedure in computing the structures of biologically active polypeptides and proteins, 14:31977 (BA;US)
Design of a four-helix bundle protein, 14:32129 (BA;US)
Internal packing and protein structural classes, 14:32120 (BA;US)
Metal ions in proteins: structural and functional roles, 14:32136 (BA;US)
Molecular dynamics: applications to proteins, 14:32115 (BA;US)
Protein architecture and the origin of introns, 14:32170 (BA;US)
Quantum mechanics and molecular computing: mutual implications, 14:32195 (BA;US)
Zinc fingers: a novel protein fold for nucleic acid recognition, 14:32124 (BA;US)

Transport
The role of transit peptides in the localization of chloroplastic proteins: Progress report, 14:32172 (R;US)

PROTON BEAMS

Uranium
M-subshell ionization of U by light ion bombardment, 14:32499 (RA;BR)

PROTON REACTIONS

Elastic Scattering
Peaks in the valley: Searching for resonances in large angle exclusive scattering, 14:32565 (J;US)

Isomer Ratio
Study on isomeric ratios in the /sup 45/Sc(γ,n)/sup 44mg/Sc and /sup 44/Ca(p,n)/sup 44mg/Sc reactions, 14:32666 (R;SU;In Russian)

Pair Production
Threshold behavior of electron pair production in *p*-Be collisions, 14:32659 (J;US)

Particle Production
High-resolution measurement of massive-dielectron production in 800-GeV proton-beryllium collisions, 14:32579 (J;US)

Pickup Reactions
$^{148}Gd(p,t)^{146}Gd$ reaction: Neutron states in ^{146}Gd, 14:32676 (J;US)

Spallation
Baryon production in the central region of ultrarelativistic heavy-ion collisions, 14:32745 (J;US)
Isobaric yield curves at A=72 from the spallation of medium mass isotopes by intermediate energy protons, 14:32671 (J;US)

Superfluid Model
Evaporation neutron spectra and nuclear level density, 14:32727 (RA;SU;In Russian)

PROTON-ANTIPROTON INTERACTIONS
$\bar{p}p$ collider physics, 14:32544 (R;US)

Particle Production
Aspects of top-quark searches in TeV hadron collisions, 14:32576 (J;US)
Preliminary results of $\bar{p}p$ at 8 GeV/c, 14:32564 (J;US)
Search for top-quark decays to real W bosons at the Fermilab Tevatron collider, 14:32578 (J;US)
E/ι in hadroproduction, 14:32552 (J;US)

Total Cross Sections
Measurement of rho(S)=ReT(S,O)/ImT(S,O) at the collider and its interpretation in a model with odd-c exchange, 14:32588 (R;SU)

PROTON-NEUTRON INTERACTIONS

Particle Production
Inevitable dibaryons, 14:32599 (J;US)

PROTON-NUCLEON INTERACTIONS
See also PROTON-NEUTRON INTERACTIONS
PROTON-PROTON INTERACTIONS

Pair Production
Threshold behavior of electron pair production in *p*-Be collisions, 14:32659 (J;US)

Particle Production
Prospects for B physics spectroscopy in Fermilab fixed target experiments, 14:32556 (J;US)

PROTON-PROTON INTERACTIONS

Elastic Scattering
Activity report, 14:32650 (R;FR;In French)

Gev Range 01-10
Activity report, 14:32650 (R;FR;In French)

Particle Production
Observation of structures in the mass range of 2700 to 2900 MeV in the difference between the *pp* total cross sections for pure helicity states, 14:32575 (J;US)
Some preliminary results from BNL E766 on $pp \rightarrow pp K_S^0 K\pi$, 14:32561 (J;US)
The search for scalar mesons, 14:32553 (J;US)
E/ι in hadroproduction, 14:32552 (J;US)

Total Cross Sections
Measurement of rho(S)=ReT(S,O)/ImT(S,O) at the collider and its interpretation in a model with odd-c exchange, 14:32588 (R;SU)

PROTONS

Attenuation
Shielding of low-energy cyclotrons, 14:31700 (RA;AT;In German)

Diffusion
Diffusion of tritons, deuterons, and protons in $LiNbO_3$ crystals, 14:31366 (J;US)

Energy Spectra
High energy electron and proton observations in the South Atlantic geomagnetic anomaly, 14:32474 (RA;BR)
Intensity maps of MeV electrons and protons below the radiation belt, 14:32475 (RA;BR)

Energy Transfer
Effects of external ions upon proton transfer reactions: H-bonded systems containing HCOOH, 14:32188 (BA;US)

Magnetic Storms
High energy electron and proton observations in the South Atlantic geomagnetic anomaly, 14:32474 (RA;BR)
Observation of high energy electrons and protons in the South Atlantic geomagnetic anomaly by Ohzora Satellite, 14:32473 (RA;BR)

Maps
Intensity maps of MeV electrons and protons below the radiation belt, 14:32475 (RA;BR)

Particle Decay
The Soudan 2 proton decay experiment, 14:31801 (R;US)

Radiation Belts
Intensity maps of MeV electrons and protons below the radiation belt, 14:32475 (RA;BR)

Southern Hemisphere
High energy electron and proton observations in the South Atlantic geomagnetic anomaly, 14:32474 (RA;BR)
Observation of high energy electrons and protons in the South Atlantic geomagnetic anomaly by Ohzora Satellite, 14:32473 (RA;BR)

PROTOPLASTS
See PLANT CELLS

PSI RESONANCES
See MESONS

PSI-3105 RESONANCES
See J PSI-3097 MESONS

PSI-4300 RESONANCES
See MESONS

PUBLIC ATTITUDES
See PUBLIC OPINION

PUBLIC BUILDINGS

Energy Management
Energy-management financing for state facilities and public schools, 14:30994 (R;US)

PUBLIC OPINION
Modifications
Improving public awareness of the importance of coal and clean coal technology, 14:30283 (R;US)
PUBLIC UTILITY REGULATORY POLICIES ACT
Regulations
Regulation of utility long-range planning, 14:31018 (RA;US)
PULMONARY CANCER
See CARCINOMAS
PULMONARY LAVAGE
See LUNGS
PULPS
See SLURRIES
PULSARS
Gamma Spectra
Spectra of crab-like pulsars: A GRO perspective, 14:32459 (R;US)
PULSE COLUMNS
See EXTRACTION COLUMNS
PULSE GENERATORS
See also HIGH-VOLTAGE PULSE GENERATORS
Design
Switched power workshop: Power supply working group, 14:31784 (R;US)
Linear Accelerators
Measuring of spectral composition of the pulse SHF generator signals, 14:31744 (RA;SU;In Russian)
PULVERIZED FUEL ASH
See FLY ASH
PUMPED LIMITERS
Efficiency
Effect of pump limiter throat on pumping efficiency, 14:32860 (R;FR)
PUMPED STORAGE POWER PLANTS
Denmark
Pumped storage power plants in Denmark, 14:30795 (R;DK;In Danish)
PUMPS
See also WATER PUMPS
Angra-1 Reactor
Transient performance of flow in circuits of PWR type reactors, 14:30837 (R;BR;In Portuguese)
Design
Remote process cell mercury transfer pumps for DWPF, 14:30495 (RA;US)
Failures
Transient performance of flow in circuits of PWR type reactors, 14:30837 (R;BR;In Portuguese)
Primary Coolant Circuits
Transient performance of flow in circuits of PWR type reactors, 14:30837 (R;BR;In Portuguese)
Technology Assessment
Well pumps, 14:30770 (RA;US)
PUREX PROCESS
Extraction Columns
On the identification of fluiddynamical phenomena in pulsed extraction columns by means of radiotracers, 14:30442 (R;DE;In German)
PURINES
Biosynthesis
Prebiotic synthesis: problems and challenges, 14:32081 (BA;US)
PURITY
See IMPURITIES
PURPA
See PUBLIC UTILITY REGULATORY POLICIES ACT
PVC
Combustion
Economics of PVC incineration, 14:30488 (RA;US)
Fractionation
Separation and characterization of colloidal materials of variable particle size and composition by coupled column sedimentation field-flow fractionation, 14:31410 (J;US)
Sedimentation
Separation and characterization of colloidal materials of variable particle size and composition by coupled column sedimentation field-flow fractionation, 14:31410 (J;US)
Volatile Matter
Health-hazard evaluation determination report No. 73-123-298, Campbell Plastics, Inc., Schenectady, New York, 14:31962 (R;US)
PWR TYPE REACTORS
See also ANGRA-1 REACTOR
CATAWBA-2 REACTOR
KRSKO REACTOR
OBRIGHEIM REACTOR
SEABROOK-1 REACTOR
SEABROOK-2 REACTOR
TROJAN REACTOR
ZION-1 REACTOR
ZION-2 REACTOR
Fabrication, pre-irradiation characterization and base-irradiation data of test fuel rod group PK1X: The Super-Ramp Extenstion Project, 14:30843 (R;SE)
PWR steam generator tube fretting and fatigue wear: Final report, 14:30839 (R;US)
Control Systems
Provisions and active measures to preclude guillotine breaks in piping systems of pressurized water reactors, 14:30905 (R;BR)
Failures
Provisions and active measures to preclude guillotine breaks in piping systems of pressurized water reactors, 14:30905 (R;BR)
Fuel Rods
The Studsvik Super-Ramp Extension Project: Ceramography of Asea Atom test fuel rod OL1-1, 14:30832 (R;SE)
The Studsvik Super-Ramp Extension Project: Destructive post-irradiation examinations of rod group PK 1X, 14:30836 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1984–February 28, 1985, 14:30831 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, October 1, 1985–March 31, 1986, 14:30835 (R;SE)
Fuel-Cladding Interactions
The Studsvik Super-Ramp Extension Project: Non destructive examinations of the PK1X rod and the rod OL1-5, 14:30834 (R;SE)
The Studsvik Super-Ramp Extension Project: Progress report, March 1, 1985–September 30, 1985, 14:30833 (R;SE)
Meltdown
Behavior of a corium jet in high pressure melt ejection from a reactor pressure vessel, 14:30841 (R;SE)
Occupational Exposure
Occupational exposures and practices in nuclear power plants, 14:30895 (R;US)
Pipes
Provisions and active measures to preclude guillotine breaks in piping systems of pressurized water reactors, 14:30905 (R;BR)
Radioactive Waste Storage
Evaluation of potential benefits of transportable storage casks: Final report, 14:30822 (R;US)
Reactor Safety
Remarks before the Beijing meeting of the pacific basin conference, 14:31003 (J;US)
Steam Generators
MULTEQ: Equilibrium of an electrolytic solution with vapor-liquid partitioning and precipitation: Volume 1: User's manual, Revision 1, 14:30838 (R;US)
Stress Corrosion
Proceedings: 1986 workshop on advanced high-strength materials, 14:30821 (R;US)
Water Chemistry
Evaluation of non-radiological water chemistry at power reactors, 14:30824 (R;US)
PYRANS
Thermodynamic Properties
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)

PYRIDINE
Adsorption
Near-infrared surface-enhanced Raman spectroscopy. Part I: Copper and gold electrodes, 14:31356 (J;US)
Sorption of pyridine and quinoline onto rundle spent shale, 14:30421 (RA;CN)
Raman Spectra
Near-infrared surface-enhanced Raman spectroscopy. Part I: Copper and gold electrodes, 14:31356 (J;US)
Raman Spectroscopy
Surface plasmon polariton enhancement of Raman scattering in Kretschmann geometry, 14:31462 (J;US)
PYRIDINES
See also BIPYRIDINES
PIPERIDINES
PYRIDINE
QUINOLINES
Chemical Reactions
Guanidyl groups: new metal-binding ligands in biomolecules. Reactions of chloro(2,2':6',2"-terpyridine)platinum(II) with arginine in two cytochromes c and with other guanidyl ligands, 14:31505 (J;US)
Denitration
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
Removal
Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
PYRITE
Oxidation
Acid mine drainage potential of raw, retorted, and combusted Eastern oil shale: Final report, 14:30420 (R;US)
PYRITES
See PYRITE
PYROCATECHIN
See PYROCATECHOL
PYROCATECHOL
Molecular Structure
Shape description of conformationally flexible molecules: application to two-dimensional conformational problems, 14:32180 (BA;US)
PYROLYSIS
Gas Analysis
Analysis of low-pressure gas-phase pyrolytic reactions by mass spectrometric techniques, 14:31582 (R;DK)
Spectroscopy
Micropyrolyzer design for infrared spectroscopy applications, 14:31336 (R;US)
PYRROLES
See also PYRROLIDINES
PYRROLIDONES
Denitration
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
Removal
Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
PYRROLIDINES
Denitration
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
PYRROLIDONES
Thermodynamic Properties
Determination of some pure compound ideal-gas enthalpies of formation, 14:30311 (R;US)
PZT
Dielectric Properties
Dielectric and piezoelectric properties of PZT sintered in low temperatures, 14:31280 (R;BR;In Portuguese)
Piezoelectricity
Dielectric and piezoelectric properties of PZT sintered in low temperatures, 14:31280 (R;BR;In Portuguese)

Q

QUANTITATIVE CHEMICAL ANALYSIS
Automation
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
Metabolites
TNT metabolites in animal tissues: Quarterly technical progress report No. 2, January 1, 1989–March 31, 1989, 14:32398 (R;US)
Multi-Element Analysis
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
QUANTUM CHROMODYNAMICS
Chiral Symmetry
Chiral symmetry breaking and nonperturbative scale anomaly in gauge field theories, 14:32617 (R;SU)
Dynamical breakdown of chiral symmetry in vectorial theories: QED and QCD, 14:32628 (R;BR;In Portuguese)
Drell Model
Effects of initial-state QCD interactions in the Drell-Yan process, 14:32644 (J;US)
Heisenberg Model
Deconfinement analysis in exactly solvable model of lattice QCD in strong coupling approximation, 14:32631 (R;SU)
Lattice Field Theory
The world according to lattice QCD, 14:32636 (J;US)
Phase Transformations
Deconfinement analysis in exactly solvable model of lattice QCD in strong coupling approximation, 14:32631 (R;SU)
String Models
Coherence effects in parton showers, 14:32590 (R;SE)
Symmetry Breaking
Chiral symmetry breaking and nonperturbative scale anomaly in gauge field theories, 14:32617 (R;SU)
Dynamical breakdown of chiral symmetry in vectorial theories: QED and QCD, 14:32628 (R;BR;In Portuguese)
Testing
Experimental evidence for the non-Abelian nature of QCD from a study of multijet events produced in e^+e^- annihilation, 14:32570 (J;US)
QUANTUM ELECTRODYNAMICS
Annihilation
Study of the e/sup +/e/sup -/ annihilation reaction into four leptons, 14:32634 (R;FR;In French)
Chiral Symmetry
Dynamical breakdown of chiral symmetry in vectorial theories: QED and QCD, 14:32628 (R;BR;In Portuguese)
Electron Reactions
Study of the e/sup +/e/sup -/ annihilation reaction into four leptons, 14:32634 (R;FR;In French)
Gauge Invariance
Gauge-invariant correlation functions, 14:32643 (J;US)
Symmetry Breaking
Dynamical breakdown of chiral symmetry in vectorial theories: QED and QCD, 14:32628 (R;BR;In Portuguese)
QUANTUM FIELD THEORY
See also LATTICE FIELD THEORY
PHI4-FIELD THEORY
QUANTUM CHROMODYNAMICS
QUANTUM ELECTRODYNAMICS
QUANTUM GRAVITY
Conformal Invariance
Structure constants of the (A,D) minimal C less than 1 conformal models, 14:32629 (R;IT)
Physical Properties
Dynamics of non-integrable phases and gauge symmetry breaking, 14:32637 (J;US)

QUANTUM GRAVITY
Gauge Invariance
Gauge invariant gravitation theory. 1. Gravitational field source and spin, 14:32632 (R;SU;In Russian)
Gravitational Fields
Gauge invariant gravitation theory. 1. Gravitational field source and spin, 14:32632 (R;SU;In Russian)
QUANTUM MECHANICS
Bohr Theory
Applications of Bohr's correspondence principle, 14:32846 (J;US)
Electrons
Landau levels and cyclotron masses in Ga Al-Al Ga As quantum wells, 14:32822 (RA;BR)
Gallium Arsenides
Landau levels and cyclotron masses in Ga Al-Al Ga As quantum wells, 14:32822 (RA;BR)
Hall Effect
Quantum Hall effect and the electrostatic Aharonov-Bohm effect, 14:32832 (R;DK)
Hamiltonians
Semiclassical structure of Hamiltonians, 14:32856 (J;US)
Magnetic Fields
Landau levels and cyclotron masses in Ga Al-Al Ga As quantum wells, 14:32822 (RA;BR)
Probability
Euclidean quantum mechanics: Analytical approach, 14:32838 (R;DE)
Stochastic Processes
On stochastic quantization, 14:32827 (R;SU;In Russian)
Testing
Resonance fluorescence and quantum jumps in single atoms: Testing the randomness of quantum mechanics, 14:32844 (J;US)
Wave Functions
Quantum dynamics of a pulsed spin system: Long-time behavior of semiclassical wave functions, 14:32858 (J;US)
QUARK CONFINEMENT
See BAG MODEL
QUARK MATERIAL
See QUARK MATTER
QUARK MATTER
Final-State Interactions
Contribution of the final state interactions to the suppression of the J/PSI meson produced in high-energy nucleus-nucleus collisions, 14:32732 (R;FR)
Green Function
Linear response of hot gluons, 14:32596 (J;US)
Nucleon Reactions
Contribution of the final state interactions to the suppression of the J/PSI meson produced in high-energy nucleus-nucleus collisions, 14:32732 (R;FR)
QUARK PLASMA
See QUARK MATTER
QUARK SEA
See QUARK MATTER
QUARK-GLUON PLASMA
See QUARK MATTER
QUARKS
Decay
Search for top-quark decays to real *W* bosons at the Fermilab Tevatron collider, 14:32578 (J;US)
Kobayashi-Maskawa Matrix
New parametrization of the Kobayashi-Maskawa matrix and its implications, 14:32613 (J;US)
Particle Identification
Aspects of top-quark searches in TeV hadron collisions, 14:32576 (J;US)
Particle Interactions
Interpreting four-quark interactions in finite-temperature, SU(2), lattice gauge theory, 14:32641 (J;US)
Particle Production
Search for top-quark decays to real *W* bosons at the Fermilab Tevatron collider, 14:32578 (J;US)
QUARTZ
Fabrication
Chemically amplified laser direct-writing of aluminum, 14:31341 (BA;US)
Hydrothermal Alteration
An experimental study of hydroxyl in quartz using infrared spectroscopy and ion microprobe techniques, 14:30761 (J;US)
QUASIPARTICLE-PHONON MODEL
Coupling
Interactions between quasiparticles and phonons in odd-even nuclei in the region of /sup 88/Sr and /sup 90/Zr, 14:32735 (R;DE;In German)
QUEBEC
Acid Rain
Studies of the ionic balance of Laflamme Lake in 1985 and 1986, 14:32034 (R;CA;In French)
Energy Policy
Energy: driving force of economic development, 14:30977 (R;CA)
Energy Source Development
Energy: driving force of economic development, 14:30977 (R;CA)
Lakes
Studies of the ionic balance of Laflamme Lake in 1985 and 1986, 14:32034 (R;CA;In French)
Metal Industry
Recycling of iron and steel. State of the situation, 14:31152 (R;CA;In French)
Paper Industry
Recycling of secondary fibers by the Quebec paper industry, 14:31128 (R;CA;In French)
Recycling
Recycling of iron and steel. State of the situation, 14:31152 (R;CA;In French)
Recycling of secondary fibers by the Quebec paper industry, 14:31128 (R;CA;In French)
QUIESCENT PLASMA
Boundary Layers
Experimental studies on the surface confined quiescent plasma at INPE, 14:32781 (RA;BR)
Ion Acoustic Waves
Experimental studies on the surface confined quiescent plasma at INPE, 14:32781 (RA;BR)
Solid-State Plasma
Experimental studies on the surface confined quiescent plasma at INPE, 14:32781 (RA;BR)
QUINOLINES
See also OXINE
Adsorption
Sorption of pyridine and quinoline onto rundle spent shale, 14:30421 (RA;CN)
8-QUINOLINOL
See OXINE
QUINONES
Electron Transfer
Effect of triplet spin dynamics memory in electron-transfer reactions. Fourier transform-electron paramagnetic resonance spectroscopy, 14:31565 (J;US)
Hydrogen Transfer
Long-lived quinone-naphthalene triplet excited complexes: direct measure of rates of proton transfer within intimate radical ion pairs, 14:31566 (J;US)
Molecular Structure
Shape description of conformationally flexible molecules: application to two-dimensional conformational problems, 14:32180 (BA;US)
Surface Properties
Organized monolayers of polycyclic aromatic quinones, 14:31509 (J;US)

R

R-1650 RESONANCES
See MESONS

R-B REACTOR
Radiation Monitoring
Neutron and gamma radiation doses topography around the rb reactor, 14:30916 (RA;AT)

R-RNA
See RIBOSOMAL RNA

RADAPPERTIZATION
See RADIOSTERILIZATION

RADAR
See also SYNTHETIC-APERTURE RADAR
Expert Systems
An expert system for correlation of radar and passive sensor signals, 14:32988 (R;US)
Performance
Evaluation of two search radar systems for detection of ice masses, 14:31669 (R;CA)

RADIANT HEATERS
Technology Assessment
An investigation into the state-of-the-art of dielectric heating applications for lamination, 14:31121 (R;CA)
Radiant wave technology. As a source of energy savings, 14:31119 (R;CA)

RADIATION BURDEN
See RADIATION DOSES

RADIATION DAMAGE (BIOLOGICAL)
See RADIATION INJURIES

RADIATION DAMAGE (NONBIOLOGIC)
See RADIATION EFFECTS

RADIATION DETECTION AND RANGE
See RADAR

RADIATION DOSEMETERS
See DOSEMETERS

RADIATION DOSES
One-Dimensional Calculations
On the importance of probability distributions of parameters in dose assessments, 14:32774 (RA;AT)
Probabilistic Estimation
On the importance of probability distributions of parameters in dose assessments, 14:32774 (RA;AT)
Regulations
Problems of regulating radiation exposure of the public, 14:30912 (RA;AT)
Three-Dimensional Calculations
Calculation on free-in-air kermas and effective dose equivalents from radioisotopes deposited on soil, 14:32767 (RA;AT)
Kerma rates and whole-body absorbed dose rates for immersion in a semi-infinite cloud, 14:32766 (RA;AT)
Uranium Mines
Radiation exposure of the public from operations of ranger uranium mines, 14:30639 (RA;AT)

RADIATION DOSIMETRY
See DOSIMETRY

RADIATION EFFECTS
See also BIOLOGICAL RADIATION EFFECTS
Physics of radiation defects and radiation material science. Scientific-technical collection, 14:31173 (R;SU;In Russian)

RADIATION EXPOSURE (DOSES)
See RADIATION DOSES

RADIATION HARDENING (CHEMICAL)
See POLYMERIZATION

RADIATION HYGIENE
See RADIATION PROTECTION

RADIATION INJURIES
See also RADIODERMATITIS
Diagnostic Techniques
Thermography in diagnosis of local radiation injury, 14:32386 (RA;AT)
Risk Assessment
Scientific basis for risk assessment and legal aspects of compensation of claims related to occupational and non-occupational radiation exposure, 14:30911 (RA;AT)
Victims Compensation
Scientific basis for risk assessment and legal aspects of compensation of claims related to occupational and non-occupational radiation exposure, 14:30911 (RA;AT)

RADIATION MONITORING
Environment
Environmental survey at Lucas Heights Research Laboratories, 1985, 14:30621 (R;AU)

RADIATION MONITORS
See also EXPOSURE RATEMETERS
Glass Scintillators
On-line monitor for cation exchange elution chromatography using lithium silicate glass beads as solid scintillator, 14:31806 (R;CN;In Chinese)
Ion Exchange Chromatography
On-line monitor for cation exchange elution chromatography using lithium silicate glass beads as solid scintillator, 14:31806 (R;CN;In Chinese)
Performance
Direct assay of drummed evaporator bottoms, dry active waste, and filter cartridges at the Ginna Nuclear Station, 14:30462 (RA;US)
Proportional Counters
Investigation on the performance of a TEPC dose-equivalent meter for area monitoring, 14:31845 (RA;AT)

RADIATION PROTECTION
Contributions to the study of environmental radioactivity, 14:32009 (R;RO;In Romanian)
Cost Benefit Analysis
Reliability of protection measures used in solving optimization tasks in radiation protection, 14:30628 (RA;AT;In German)
Dose Limits
Critical comments on the current system of radiation protection and suggestions for improvement, 14:32768 (RA;AT)
Dosimetry
Critical comments on the current system of radiation protection and suggestions for improvement, 14:32768 (RA;AT)
Evaluation
ASA conference on radiation and health, Coolfont VI: Final report, 14:32369 (R;US)
Historical Aspects
Twenty-five years of alara, 14:32381 (RA;AT)
Human Factors
Possible application of fuzzy set theory to radiation protection and risk assessment, 14:33006 (RA;AT)
Meetings
4. European congress and 13. regional congress of IRPA. 20 years experience in radiation protection - a review and outlook, 14:32377 (R;AT;In German, English)
Reliability
Reliability of protection measures used in solving optimization tasks in radiation protection, 14:30628 (RA;AT;In German)
Safety Standards
Highlights in the evolution of radiation protection practices, 14:32764 (RA;AT)
Standardization
Standardization in radiation protection, 14:32765 (RA;AT;In German)
Standards
Biological assessment of occupational exposure to actinides: Programme; Book of Abstracts, 14:32368 (R;FR)

RADIATION PROTECTION GUIDES
See RECOMMENDATIONS

RADIATION PROTECTION LAWS
Ideas for a practice-oriented radiation protection law, 14:30635 (RA;AT;In German)
Optimization
Legal aspects of justification and optimization in radiation protection, 14:30636 (RA;AT;In German)

RADIATION SAFETY
See RADIATION PROTECTION

RADIATION TRANSPORT
See also CHARGED-PARTICLE TRANSPORT

Monte Carlo Method
Importance biasing for 1-D deep-penetration problem by Monte Carlo, 14:32747 (R;IN)

RADICIDATION
Quality Control
Detection of the irradiation of foods, 14:31570 (RA;IL)

RADIO EQUIPMENT
See also RADIO TELESCOPES
Performance Testing
Communication in hazardous environments, 14:31592 (RA;US)

RADIO RECEIVERS
See RADIO EQUIPMENT

RADIO TELESCOPES
Performance
Performance of the 13.7 m Itapetinga radiotelescope, 14:31796 (RA;BR)

RADIO TRANSMITTERS
See RADIO EQUIPMENT

RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES

RADIOACTIVE CLOUDS
Thermal Diffusion
Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)

RADIOACTIVE EFFLUENTS
Biological Effects
Evaluation of stream biological communities in nonthermal reaches of Four Mile Creek: Revision 1, 14:32052 (R;US)
Radiation Monitoring
Aspects of controlling the radioactive waste water released by nuclear power plants at the Paks NPP, 14:30883 (RA;AT)
Radioecology
Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)

RADIOACTIVE GASEOUS WASTES
See GASEOUS WASTES
RADIOACTIVE WASTES

RADIOACTIVE MATERIALS
See also FISSION PRODUCTS
RADIOACTIVE WASTES
Materials Handling
Operating experience and procedures at the tritium systems test assembly, 14:32943 (J;US)
Transport
An analysis of severe air transport accidents, 14:30597 (R;US)
Enclosure of radioactive materials. Regulations, standards and practical experience, 14:30638 (RA;AT;In German)
Heat transfer in severe accident simulations, 14:30601 (R;US)

RADIOACTIVE PARTICULATES
See PARTICLES

RADIOACTIVE WASTE DISPOSAL
A new tritium facility - The Weapons Engineering Tritium Facility at Los Alamos National Laboratory, 14:32938 (J;US)
Transportation of tritiated waste from fusion facilities, 14:32940 (J;US)
Casks
Automatic measuring station to monitor radioactive waste containers, 14:30630 (RA;AT;In German)
Clays
Study on sealing of boreholes, 14:30552 (R;FR;In Italian)
Granites
Scale effect experiment in a fractured rock mass phase 2. Volume 1. Description of hydraulic tests carried out on the experimental site at Fanay-Augeres, 14:30555 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 2. Interpretation and modelling of the hydraulic tests carried out on the experimental site at Fanay-Augeres, 14:30556 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 3. Description of the tracer tests carried out on the experimental site at Fanay-Augeres, 14:30557 (R;FR;In French)
Scale effect experiment in a fractured rock mass phase 2. Volume 5. Methodology and results of in-situ stress measurement carried out in the granitic rock mass at Fanay-Augeres, 14:30559 (R;FR;In French)
Scale effects experiment in a fractured rock mass phase 2. Volume 4. Interpretation and modelling of the tracer tests carried out on the experimental site at Fanay-Augeres, 14:30558 (R;FR;In French)
Land Use
Disposal of radioactive waste in land burial facilities at Studsvik. Inspection notes, 14:30641 (R;SE;In Swedish)
Microorganisms
Micro-organisms and nuclear waste: a neglected problem, 14:30563 (R;GB)
P Codes
Guide to PICKER - a data selection program for the geochemical code PHREEQE, 14:32071 (R;GB)
Prediction of radiation effects from proposed low-level waste disposal sites in Turkey, 14:32023 (J;US)
Packaging
Dose rates of waste packagings. A manual for activity determination of single radionuclide mixtures in standardized waste packagings resulting from dose rate limits, 14:30574 (R;DE;In German)
Regulations
Barnwell disposal site issues - 1985, 14:30549 (RA;US)
Impact of regulations on operation of a LLW burial site, 14:30541 (RA;US)
Land burial facility at the Forsmark plant. Inspection notes, 14:30640 (R;SE;In Swedish)
Risk Assessment
System design for disposal of tritium at TFTR, 14:32946 (J;US)
Toxicity
Chemical risks from nuclear waste repositories, 14:30626 (R;SE)
Underground Disposal
Rock sealing - interim report on the rock seealing project (stage 1), 14:30608 (R;SE)

RADIOACTIVE WASTE FACILITIES
See also PAMELA PLANT
WIPP
Communications
Communication in hazardous environments, 14:31592 (RA;US)
Construction
Environmental program planning for the proposed high-level nuclear waste repository at Yucca Mountain, Nevada: Volume 1, 14:30528 (R;US)
Iowa Electric's addition of a low level radwaste processing and storage facility to the Duane Arnold Energy Center, 14:30548 (RA;US)
Design
CEGB experience in immobilizing radioactive resins, sludges, and related wastes, 14:30479 (RA;US)
Design and fabrication experience with the AZTECH radwaste equipment, 14:30472 (RA;US)
Incorporating functional requirements into the structural design of the DWPF, 14:30492 (RA;US)
Plant for immobilizing low-level aqueous waste in water extendible polymer, 14:30481 (RA;US)
Supernatant treatment system at the West Valley Demonstration Project, 14:30460 (RA;US)
Environmental Effects
A statistical approach for characterizing chemical durability within a waste glass compositional region, 14:31348 (J;US)
Inventories
Tank farm surveillance and waste status summary report for March 1989, 14:30614 (R;US)
Operating Licenses
English translation of three documents relating to the SFR-1. Operating permission. Radiation protection instructions. Chapter 4 of the assessment memorandum, 14:30607 (R;SE)
Performance Testing
High-level liquid waste treatment: process development studies in the WIPE facility, 14:30503 (RA;US)

Radiation Protection
English translation of three documents relating to the SFR-1. Operating permission. Radiation protection instructions. Chapter 4 of the assessment memorandum, 14:30607 (R;SE)
Technology Assessment
Transportable volume reduction bitumen solidification system from design to operation, 14:30467 (RA;US)
Valves
Design and testing of the Defense Waste Processing Facility melter drain valve, 14:30507 (RA;US)

RADIOACTIVE WASTE MANAGEMENT
Spent Fuel Casks
Thermal analyses of a generic rail cask model and thermal response of a test article using different high temperature boundary conditions, 14:30598 (R;US)

RADIOACTIVE WASTE PROCESSING
A new tritium facility - The Weapons Engineering Tritium Facility at Los Alamos National Laboratory, 14:32938 (J;US)
Physical inventory by use of modeling for the tritium aqueous waste recovery system, 14:32952 (J;US)
Transportation of tritiated waste from fusion facilities, 14:32940 (J;US)
Comparative Evaluations
Evaluation of treatment alternatives for wastes from both spent fuel rod consolidation and miscellaneous commercial activities, 14:30473 (RA;US)
Encapsulation
Inorganic anion exchangers for the treatment of radioactive wastes, 14:30532 (R;GB)
Organic resin anion exchangers for the treatment of radioactive wastes, 14:30533 (R;GB)
Ion Exchange Materials
Methods for improved radwaste ion-exchange processing, 14:30457 (RA;US)
Optimization
Optimization of waste management by actions taken at source, 14:30560 (R;FR)
Radioactive Effluents
Inorganic anion exchangers for the treatment of radioactive wastes, 14:30532 (R;GB)
Organic resin anion exchangers for the treatment of radioactive wastes, 14:30533 (R;GB)
Service Sector
Radwaste processing services - examination of future role, 14:30470 (RA;US)

RADIOACTIVE WASTE STORAGE
Diffusion Barriers
Tritium penetration through concrete, 14:30618 (J;US)
Intermediate-Level Radioactive Wastes
Progress in the assessment of the corrosion of low and intermediate level waste containers under repository conditions, 14:31218 (R;GB)
Low-Level Radioactive Wastes
Progress in the assessment of the corrosion of low and intermediate level waste containers under repository conditions, 14:31218 (R;GB)
Packaging
Dose rates of waste packagings. A manual for activity determination of single radionuclide mixtures in standardized waste packagings resulting from dose rate limits, 14:30574 (R;DE;In German)
Rocks
Site characterization and validation. Borehole radar investigations, Stage 1, 14:30609 (R;SE)
Site Surveys
Site characterization and validation. Borehole radar investigations, Stage 1, 14:30609 (R;SE)

RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
HIGH-LEVEL RADIOACTIVE WASTES
INTERMEDIATE-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Classification
Transportation of tritiated waste from fusion facilities, 14:32940 (J;US)
Compacting
Mobile supercompaction service for DAW, 14:30478 (RA;US)
Containers
Dynamic fracture behavior of nodular cast iron, 14:31206 (R;BR)
Transportation of tritiated waste from fusion facilities, 14:32940 (J;US)
Encapsulation
CEGB experience in immobilizing radioactive resins, sludges, and related wastes, 14:30479 (RA;US)
Packaging
Design basis for resistance to shock and vibration, 14:30599 (R;US)
Radioactive Waste Processing
Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass, 14:30604 (R;SE)
Reprocessing
Potentiality of nonorganophosphorus extractants in chemical separations of actinides, 14:30443 (J;US)
Solidification
Application of decontamination solution process methods, 14:30475 (RA;US)
Specifications
Location-independent study concerning the construction, operation and closure of possible facilities for the final storage of radioactive waste in rock-salt formations in the Netherlands. Executed by Van Hattum and Blankevoort asked for by the Netherlands Energy Research Foundation and subsidized by the Ministry of Economic Affairs, 14:30564 (R;NL;In Dutch)
Storage Facilities
Location-independent study concerning the construction, operation and closure of possible facilities for the final storage of radioactive waste in rock-salt formations in the Netherlands. Executed by Van Hattum and Blankevoort asked for by the Netherlands Energy Research Foundation and subsidized by the Ministry of Economic Affairs, 14:30564 (R;NL;In Dutch)
Transport
Design verification testing, 14:30591 (R;US)
Vitrification
Basaltic glasses from Iceland and the deep sea: Natural analogues to borosilicate nuclear waste-form glass, 14:30604 (R;SE)
In situ vitrification - a status of the technology, 14:30514 (RA;US)
Waste Processing
Criteria for choice of decontaminating agents for trouble-free processing of radioactive waste waters from the control area of nuclear power plants, 14:30568 (RA;AT;In German)
Waste Processing Plants
The data collection system for failure/maintenance at the tritium systems test assembly, 14:32941 (J;US)

RADIOACTIVITY
See also NATURAL RADIOACTIVITY
Isotope Ratio
Determination of radioactive emission origins based on analyses of isotopic composition, 14:31987 (R;SE;In Swedish)
Measuring Methods
Measurement techniques for the estimation of the Rn-222 concentration and the exhalation rate indoors and outdoors using an activated carbon bed, 14:31826 (RA;AT)

RADIOBIOLOGICAL EFFECTS
See BIOLOGICAL RADIATION EFFECTS

RADIODERMATITIS
Radioprotective Substances
New trends in skin protection from ionizing radiations, 14:32374 (RA;SU;In Russian)

RADIODIAGNOSIS (RADIONUCLIDES)
See DIAGNOSIS
NUCLEAR MEDICINE

RADIOECOLOGICAL CONCENTRATION
Food Chains
Environmental radioactivity in Chile - during 1987 - Technical information, 14:32756 (R;CL;In Spanish)
Statistics
A statistical analysis of measured river contamination at selected shoreline locations, 14:32053 (R;US)
RADIOFREQUENCY SYSTEMS
See RF SYSTEMS
RADIOGRAPHY (BIOMEDICAL)
See BIOMEDICAL RADIOGRAPHY
RADIOISOTOPE KINETICS
See RADIONUCLIDE KINETICS
RADIOISOTOPE MIGRATION
See RADIONUCLIDE MIGRATION
RADIOISOTOPES
Deposition
Gamma shielding by buildings, 14:31600 (RA;AT;In German)
Medicine
Medical radionuclides in the Austrian environment, 14:32011 (RA;AT)
Uses
Some uses of radioisotope techniques in Portugal, 14:30647 (RA;BR)
RADIOLOGICAL PROTECTION
See RADIATION PROTECTION
RADIOLOGICAL WARFARE
Computerized Simulation
Preliminary assessment of the impact of incorporating a detailed algorithm for the effects of nuclear irradiation on combat crew performance into the Janus combat simulation, 14:33030 (R;US)
RADIOLOGY
See also BIOMEDICAL RADIOGRAPHY
RADIOTHERAPY
Measuring Methods
Measurement of regional cerebral blood flow by intravenous administation of 133 xenon. Theory, technique and clinical applications, 14:32360 (R;SE)
RADIOMETERS
Calibration
SERI results from the PEP 1987 Summit Round Robin and a comparison of photovoltaic calibration methods, 14:30738 (R;US)
Data Acquisition
Spectral measurement SMHI. Final report, 14:31877 (R;SE;In Swedish)
Solar Radiation
Spectral measurement SMHI. Final report, 14:31877 (R;SE;In Swedish)
RADIOMETRIC GAGES
Balances
Radiometric weighing devices. Part 1 and 2. Fundamentals, design, and applications, 14:30648 (R;DD;In German)
Radiation Protection
Radiometric weighing devices. Part 1 and 2. Fundamentals, design, and applications, 14:30648 (R;DD;In German)
RADIONUCLIDE CONCENTRATION
See RADIOACTIVITY
RADIONUCLIDE DISTRIBUTIONS
See RADIONUCLIDE KINETICS
RADIONUCLIDE KINETICS
Whole-Body Counters
Assessment of internal contamination with a whole body counter, 14:31847 (RA;AT)
Whole-Body Counting
Assessment of internal contamination with a whole body counter, 14:31847 (RA;AT)
RADIONUCLIDE METABOLISM
See RADIONUCLIDE KINETICS
RADIONUCLIDE MIGRATION
Calculation Methods
Long-term prediction of radionuclide leaching from waste matrix by finite-slab approximation method, 14:30465 (RA;US)
Field Tests
Recommendations for the determination of migration parameters by field experiments (tracer tests), 14:30885 (R;DD;In German)
Mathematical Models
Use of non-dimensional representation of the solute transport equations, 14:30534 (R;GB)
Rare Earths
Geochemistry and mobility of the lanthanides in marine sediments, 14:32051 (R;GB)
Risk Assessment
Use of non-dimensional representation of the solute transport equations, 14:30534 (R;GB)
Time-Series Analysis
A model for global cycling of tritium, 14:32959 (J;US)
RADIONUCLIDE TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
RADIONUCLIDE TRANSFER (IN ORGANISMS)
See RADIONUCLIDE KINETICS
RADIONUCLIDE TURNOVER
See RADIONUCLIDE KINETICS
RADIONUCLIDES
See RADIOISOTOPES
RADIOPASTEURIZATION
See RADICIDATION
RADIOPOLYMERIZATION
See POLYMERIZATION
RADIOPROTECTIVE SUBSTANCES
Comparative Evaluations
Biophysical test methods for radioprotectors, 14:32379 (RA;AT)
Evaluation
Potential therapeutic applications for interleukin 1: anti-tumor and hematopoietic effects, 14:32364 (R;US)
RADIOSTERILIZATION
Quality Control
Detection of the irradiation of foods, 14:31570 (RA;IL)
RADIOSURGERY
See RADIOTHERAPY
RADIOTHERAPY
See also NEUTRON THERAPY
Planning
New independent multi user/multi tasking radiotherapy treatment planning-system with on- and off-line datatransfer from CT or NMR, 14:32341 (RA;DD)
Results of postoperative radiotherapy and radiation of recurrent tumours, observed in adenomas of the pituitary gland operated at a primary stage, 14:32344 (R;DE;In German)
Radiation Doses
Cerebral tumours in adults. A review of results achieved with radiotherapy, 14:32346 (R;DE;In German)
RADIOWAVE RADIATION
See also SOLAR RADIO BURSTS
Biological Radiation Effects
Questions and answers about biological effects and potential hazards of radiofrequency radiation (third edition), 14:32406 (R;US)
RADIUM
Biological Effects
"Normal" tissues from humans exposed to radium contain an alteration in the c-mos locus, 14:32371 (R;US)
Solvent Extraction
Crown ethers as solvent extraction reagents: where do we stand?, 14:31413 (J;US)
RADIUM A
See POLONIUM 218
RADIUM G
See LEAD 206
RADON
Buildings
Radon decay product in-door behavior - parameter, measurement method, and model review, 14:31856 (R;SE)
RADON 213
High Spin States
Spectroscopy and octupole coupling of high-spin states in /sup 213/Rn, 14:32678 (R;AU)

RADON 222
Daughter Products
Development of electret technology to measure indoor radon-daughter concentrations: Final report (Phase 1), 14:31064 (R;US)
The study of neutralization of Po-218 ions by small ion recombination in O_2, Ar and N_2, 14:31061 (R;US)
Ecological Concentration
ASA conference on radiation and health: Coolfont 7: Final report, 14:32370 (R;US)
Radon generation, adsorption, absorption, and transport in porous media, 14:31062 (R;US)
Exhalation
Measurement techniques for the estimation of the Rn-222 concentration and the exhalation rate indoors and outdoors using an activated carbon bed, 14:31826 (RA;AT)
Monitoring
Validation of the diffusion-barrier charcoal canister method, 14:31063 (R;US)
Radioactivity
Measurement techniques for the estimation of the Rn-222 concentration and the exhalation rate indoors and outdoors using an activated carbon bed, 14:31826 (RA;AT)
Radioecological Concentration
Evaluation of the performance characteristics of radon and radon-daughter concentration measurement devices under controlled environmental conditions, 14:30705 (R;US)
Investigations on radon exhalation rates of the soil, 14:32010 (RA;AT;In German)
RADURIZATION
Quality Control
Detection of the irradiation of foods, 14:31570 (RA;IL)
RAIL TRANSPORT
Financing
Transit management and replacement capital planning. Transportation research record, 14:31101 (R;US)
Research Programs
Commuter, regional, and rail transit: research and analysis. Transportation Research Record, 14:31100 (R;US)
RAILROAD CARS
Thermal Analysis
Thermal analyses of a generic rail cask model and thermal response of a test article using different high temperature boundary conditions, 14:30598 (R;US)
RAINOUT
See WASHOUT
RANA
See FROGS
RANDOM PHASE APPROXIMATION
So-8 Groups
Random phase approximation studies in the fermion dynamical symmetry model: SO(8), 14:32743 (J;US)
RARE GASES
See also ARGON
HELIUM
NEON
RADON
Photoemission
Photoemission from excited states in rare gas solids by combining synchrotronradiation with a laser, 14:31321 (R;DE;In German)
RASCHIG RINGS
See COLUMN PACKING
RATE STRUCTURE
Demand Factors
Legacy of traditional planning, 14:31010 (RA;US)
RATEMETERS (DOSE)
See DOSE RATEMETERS
RATEMETERS (EXPOSURE)
See EXPOSURE RATEMETERS
RATS
Liver
NMR spectroscopy of the perfused rat liver: technical considerations, 14:32270 (RA;DD;In German)
Mortality
Inhaled ^{147}Pm and/or total-body gamma radiation: Early mortality and morbidity in rats, 14:32376 (R;US)
Nitrogen 15
Experience with /sup 15/N-NMR spectroscopy in animal experiments, 14:32265 (RA;DD;In German)
REACTION INTERMEDIATES
Chemical Reaction Yield
Production of the nitromethane aci ion by static high pressure, 14:31539 (J;US)
REACTIVITY (CHEMICAL)
See ACTIVATION ENERGY
REACTIVITY INSERTIONS
Control Elements
Pseudo-harmonics method: an application involving perturbations caused by control rod insertion in PWR reactors, 14:30874 (R;BR)
Perturbation Theory
Pseudo-harmonics method: an application involving perturbations caused by control rod insertion in PWR reactors, 14:30874 (R;BR)
Pwr Type Reactors
Pseudo-harmonics method: an application involving perturbations caused by control rod insertion in PWR reactors, 14:30874 (R;BR)
REACTOR ACCIDENTS
See also LOSS OF FLOW
MELTDOWN
Emergency Plans
How the emergency plans for reactor accidents should be revised, 14:30910 (RA;AT;In German)
Fallout
Bikini accident and Chernobyl accident, 14:32389 (RA;AT)
Radiocesium in wheat of the Po plain, 14:31983 (R;FR;In Italian)
Risk Assessment
How the emergency plans for reactor accidents should be revised, 14:30910 (RA;AT;In German)
Preliminary risks associated with postulated tritium release from production reactor operation, 14:32958 (J;US)
Transfrontier Contamination
Chernobyl nuclear reactor accident fallout: measurement and consequences. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:30919 (R;US)
REACTOR COMPONENTS
See also BREEDING BLANKETS
CONTROL ELEMENTS
FUEL ELEMENTS
REACTOR COOLING SYSTEMS
REACTOR CORES
Dosimetry
Fuel pool component sampler as an integral part of a direct assay waste characterization method, 14:30469 (RA;US)
REACTOR CONTROL RODS
See CONTROL ELEMENTS
REACTOR COOLING SYSTEMS
Biological Effects
Biological and radioecological investigations at Ringhals nuclear power plant 1968-1987, 14:30887 (R;SE;In Swedish)
C Codes
Numerical simulation of natural circulation phenomena in a PWR during TMLB' transients prior to core damage, 14:30877 (R;US)
Design
Arrangement for cooling a nuclear power plant, 14:30870 (TG;US)
Environmental Impacts
Influence of cooling water outlet of the Ringhals power plant on the coastal fish colony, 14:30886 (R;SE;In Swedish)
REACTOR CORES
Meltdown
Validation of core debris/concrete interactions and source term models, 14:30921 (R;US)
Radioactive Waste Management
TMI-2 reactor fuel removal, loading, transport, and storage, 14:30898 (RA;US)

Sampling
Manually-operated vertical articulated manipulator developed for investigation of sub-core regions, 14:31591 (RA;US)

REACTOR FUEL ELEMENTS
See FUEL ELEMENTS

REACTOR FUELS
See NUCLEAR FUELS

REACTOR KINETICS EQUATIONS
Numerical Solution
Flux weighted method for solution of stiff neutron dynamic equations and its application, 14:30896 (R;CN;In Chinese)

REACTOR LATTICE PARAMETERS
Computer Calculations
Adaptation of HAMMER computer code to CYBER 170/750 computer, 14:32991 (R;BR;In Portuguese)
H Codes
Adaptation of HAMMER computer code to CYBER 170/750 computer, 14:32991 (R;BR;In Portuguese)

REACTOR LATTICE PITCH
See REACTOR LATTICE PARAMETERS

REACTOR MONITORING SYSTEMS
Design and testing of a heated thermocouple liquid level probe, 14:30875 (R;US)

REACTOR SAFETY
Research Programs
List of reports in the field of reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC. Reported period: 1 October - 31 December 1988, 14:30904 (R;DE;In German)

REACTOR SAFETY EXPERIMENTS
Italy
Review of the nuclear safety activities in Italy, 14:30901 (R;IT;In Italian)

REACTOR SITES
Earthquakes
Data base pertinent to earthquake design basis, 14:30878 (R;IN)

REACTOR VESSELS
Cold Working
Cold forming degree and heat treatment on Wste 26 dished head, 14:30868 (R;BR)
Heat Treatments
Cold forming degree and heat treatment on Wste 26 dished head, 14:30868 (R;BR)
Mechanical Properties
Cold forming degree and heat treatment on Wste 26 dished head, 14:30868 (R;BR)

REACTORS
See also HEAVY WATER MODERATED REACTORS
POWER REACTORS
WATER COOLED REACTORS
Design
The relationship between integral experimental data and nuclear fission parameters, 14:30857 (R;US)
Heat Storage
Low-temperature heat storage at Risoe. Pilot project, 14:30960 (R;DK;In Danish)

REAGENTS
See also RHODAMINES
Thermodynamic Properties
Thermodynamic Properties of Dioxygen Difluoride (O_2F_2) and Dioxygen Fluoride (O_2F), 14:31486 (J;US)

REAL TIME SYSTEMS
Real-time measurement of the size fractionation of aerosol black carbon during the South Coast Air Quality Study, June 13–September 4, 1987, Claremont College, Claremont, California: Final report: Revision, 14:31930 (R;US)
Interactive Display Devices
Rastr-RT interactive graphics system for real time tasks, 14:31820 (R;SU;In Russian)
Spectra Unfolding
Rastr-RT interactive graphics system for real time tasks, 14:31820 (R;SU;In Russian)

RECEPTORS
Biochemical Reaction Kinetics
Conformational basis of the receptor-binding potency of normal and mutant insulin molecules with relevance to the pathophysiology of noninsulin dependent diabetes mellitus (NIDDM), 14:32184 (BA;US)
Biological Functions
Transmission of regulatory conformational changes through proteins, 14:32141 (BA;US)
Biological Localization
Modus operandi of the ribosome, 14:32151 (BA;US)
Mathematical Models
3- and 5-isoxazolol zwitterions: a model of interaction with the GABA-A receptor relating to agonism and antagonism, 14:32189 (BA;US)

RECIPROCAL TRANSLOCATIONS
See CHROMOSOMAL ABERRATIONS

RECOILS
Velocity
Recoil distributions in particle transfer, 14:32518 (J;US)

RECOMBINANT DNA
Labelling
Process of labeling specific chromosomes using recombinant repetitive DNA, 14:32176 (P;US)

RECOMMENDATIONS
American College of nuclear physicians committee to review the facilities report: 1988 edition, 14:32363 (R;US)
Materials
Transport, acceptance, storage and handling of the itens of nuclear power plants, 14:32757 (R;BR;In Portuguese)
Materials Handling
Transport, acceptance, storage and handling of the itens of nuclear power plants, 14:32757 (R;BR;In Portuguese)

RECORDED INFORMATION
See INFORMATION

RECTUM
Carcinomas
CT diagnosis of rectal tumors, 14:32256 (RA;DD;In German)
Computerized Tomography
CT diagnosis of rectal tumors, 14:32256 (RA;DD;In German)

RECYCLE (FUEL)
See FUEL CYCLE

REDOX FUEL CELLS
Research Programs
Flow batteries, 14:30967 (BA;US)

REDUCTASES
See OXIDOREDUCTASES

REFRIGERATING MACHINERY
Nonlinear Problems
Deterministic chaos in energy-technichological systems, 14:31142 (R;DK;In Danish)

REFUSE
See SOLID WASTES

REGION VIII
See FEDERAL REGION VIII

REGIONAL ANALYSIS
Administrative Procedures
Adequacy of forestry data in assessing the impact of ozone: A national perspective, 14:31921 (R;US)

REGULATIONS
Compliance
Countermeasures to hazardous chemicals, 14:31936 (R;US)
Evaluation
Workshop on rules for exemption from regulatory control: Proceedings, 14:30634 (R;US)

REGULATORS (VOLTAGE)
See VOLTAGE REGULATORS

REIMBURSEMENT
See COST RECOVERY

REINFORCED CONCRETE
Decomposition
Materials and degradation modes in an alternative LLW [low-level waste] disposal facility, 14:30455 (R;US)

RELEASE (FISSION PRODUCT)
See FISSION PRODUCT RELEASE
REM
See DOSE EQUIVALENTS
REMEDIAL ACTION
Accounting
Annual report on abandoned or uncontrolled hazardous-waste disposal sites and Hazardous Waste Remedial Fund, 1988, 14:30979 (R;US)
Verification
Results of the independent radiological verification survey of the lower Sheffield Brook floodplain, Wayne, New Jersey, 14:32021 (R;US)
REMOTE AREAS
Energy Storage Systems
Evaluation of stand-alone inverters for remote applications, 14:30818 (BA;US)
Power Supplies
Evaluation of stand-alone inverters for remote applications, 14:30818 (BA;US)
Renewable Energy Sources
Evaluation of stand-alone inverters for remote applications, 14:30818 (BA;US)
REMOTE HANDLING
Technology Assessment
Advanced handling technology project and implications for cask design, 14:30595 (R;US)
REMOTE HANDLING EQUIPMENT
See also MANIPULATORS
Design
Glass melter feed system for vitrification of radioactive waste, 14:30521 (RA;US)
Pneumatically operated grapple for handling nuclear waste packages, 14:30496 (RA;US)
Progress in the remote handling equipment, 14:30491 (RA;US)
Remote handling features of the PROTEO mock-up facilities for vitrified H.L.W. canisters, 14:30490 (RA;US)
Intermediate-Level Radioactive Wastes
Evaluation of a prototype air transport system for use in a crate handling and size reduction facility, 14:30449 (R;GB)
Specifications
Evaluation of a prototype air transport system for use in a crate handling and size reduction facility, 14:30449 (R;GB)
Technology Assessment
Decommissioning of the Niederaichbach Nuclear Power Station (KKN) - remote dismantling, 14:30897 (RA;US)
Remote handling and size reduction of solid alpha-active waste, 14:30494 (RA;US)
Remote maintenance for waste handling: application of servomanipulators to a new generation of hot cells, 14:30438 (RA;US)
REMOTE SENSING
Optimization
High resolution subsurface imaging with geophysical diffraction tomography, 14:32419 (R;US)
REPAIR PATHWAYS
See BIOLOGICAL PATHWAYS
REPUBLIC OF KOREA
Ground Water
Environmental isotope-aided studies on river water and groundwater interaction in the region of Seoul and Taegu, 14:32060 (RA;XA)
Environmental isotope-aided studies on water resources in the region of Cheju, 14:32061 (RA;XA)
Rivers
Environmental isotope-aided studies on river water and groundwater interaction in the region of Seoul and Taegu, 14:32060 (RA;XA)
RESEARCH PROGRAMS
Reviews
Basic Energy Sciences Materials Sciences programs: FWP executive summaries, 14:31228 (R;US)
RESERVE CAPACITY
See CAPACITY
RESERVOIR FLUIDS
Chemical Composition
Procedures for reservoir fluid characterization using an equation of state model. Application to fluids in the Danish North Sea, 14:30393 (R;DK)
RESERVOIR ROCK
Carbon Dioxide Injection
Improvement of CO_2 flood performance: Quarterly report, October–December 1988, 14:30291 (R;US)
Diagenesis
Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)
Geology
Integrated reservoir assessment and characterization: Final report, October 1, 1985–September 30, 1988, 14:30293 (R;US)
Heterogeneous Effects
An experimental study to determine the relative influence of fluid-fluid interactions and media heterogeneities on the growth of immiscible viscous fingers, 14:30289 (R;US)
RESID
See PETROLEUM RESIDUES
RESIDENTIAL BUILDINGS
Fire Prevention
Development of design guidelines and practices for improving residential service entrances, 14:30816 (R;CA)
Gas Heat Pumps
Gas-engine heat-pump system and component efficiency and reliability improvement. Phase 2 report, September 1986-January 1989, 14:31074 (R;US)
Gas Meters
Feasibility and analysis of fluidic-type devices in gas flow measurements. Final report, March 1987-March 1988, 14:30320 (R;US)
Retrofitting
Evaluation of DOE's Partnership in Low-Income Residential Retrofit (PILIRR) Program, 14:31075 (R;US)
Weatherization
A process evaluation of the Iowa partnerships in low-income residential retrofit program, 14:31060 (R;US)
RESIDENTIAL SECTOR
Power Demand
Forecasting and validating participation rates over time, 14:31015 (RA;US)
Time-Of-Use Pricing
Importance of market segmentation in new service and rate offerings, 14:31023 (RA;US)
RESIDUAL OILS
See PETROLEUM RESIDUES
RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES
RESINS
Efficiency
Multicomponent fixed-bed ion exchange: verification of equilibrium coherence theory, 14:31442 (J;US)
Separation of nitrogen isotopes by displacement band chromatography, 14:31491 (J;US)
RESISTANCE HEATING
Uses
Steam substitution in chemical process, petrochemical and petroleum industries, 14:31130 (R;CA)
RESONANCE CAVITIES
See CAVITY RESONATORS
RESONANCE STATES
See ENERGY LEVELS
RESORCIN
See RESORCINOL
RESORCINOL
Molecular Structure
Shape description of conformationally flexible molecules: application to two-dimensional conformational problems, 14:32180 (BA;US)

RESOURCE DEVELOPMENT
Environmental Impacts
Environmental considerations, 14:30767 (RA;US)
Legal Aspects
Regulatory and commercial aspects, 14:30765 (RA;US)
RESOURCE MANAGEMENT
Planning
Integrated resource planning: who's going to do it?, 14:31025 (RA;US)
RESOURCE RECOVERY ACTS
Annual report on performance-audit results for POHC (Principal Organic Hazardous Constituents) testing during RCRA trial burns, 14:31989 (R;US)
RESOURCE RECOVERY FACILITIES
Economics
Resource recovery facility siting: Recommendations for economic and other equity adjustments: Final report, 14:31039 (R;US)
RESPIRABLE DUSTS
See DUSTS
RESPIRATORY SYSTEM DISEASES
Pneumoconioses
Pneumoconiosis in Appalachian bituminous coal miners, 14:30284 (R;US)
RESPONSE FUNCTIONS
Neutrons
Relative sensitivity of thermoluminescent materials to 15MeV neutrons. New experimental data with respect to the shape of the glow curve and influence of the encapsulating material, 14:31841 (RA;AT)
RETORTED SHALES
See SPENT SHALES
RETORTS
Design
Design of a new oil shale retort for China's fushun region, 14:30353 (RA;CN)
Retorting of four kinds of small size oil shale with an inclining type retort, 14:30352 (RA;CN)
Technology Assessment
Technical features of Fushun-type retort today, 14:30357 (RA;CN)
RETROFITTING
Least-cost planning: profiting from the negawatt revolution, 14:31009 (RA;US)
Evaluation
Retrofit evaluation. Energy performance, 14:31090 (R;CA;In English and French)
REVEGETATION
Planning
Guidelines for revegetation of disturbed sites at the Idaho National Engineering Laboratory, 14:30622 (R;US)
RF SYSTEMS
Breakdown
Rf breakdown studies in copper electron linac structures, 14:31773 (R;US)
Ferrites
Ferritor isolator for RF power supply system of a linear accelerator, 14:31745 (RA;SU;In Russian)
Linear Accelerators
Ferritor isolator for RF power supply system of a linear accelerator, 14:31745 (RA;SU;In Russian)
Plasma Production
Some applications of rf-fields to plasmas, 14:32859 (RA;BR)
Synchronization
Timing and rf synchronization for filling PEP/SPEAR with the SLC Damping Rings, 14:31792 (R;US)
Teflon
Gridded buncher - far field extension using carbon coated teflon/sub R/ sleeves, 14:31862 (R;AU)
Uses
Some applications of rf-fields to plasmas, 14:32859 (RA;BR)
RHENIUM
Catalytic Effects
Infrared study of carbon on alumina, 14:31182 (R;US)
Deactivation
Infrared study of carbon deposits on bimetallic catalysts: Final report, September 1, 1986–August 31, 1989, 14:31467 (R;US)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
RHENIUM COMPLEXES
Catalytic Effects
Transition metal activation and functionalization of carbon-hydrogen bonds: Progress report, December 1, 1988–November 30, 1989, 14:31466 (R;US)
RHO-1500 RESONANCES
See MESONS
RHO-1700 RESONANCES
See MESONS
RHODAMINES
Energy Transfer
Excitation transport in glycerol solutions of rhodamine 640: absence of orientational correlation, 14:31541 (J;US)
RHODIUM
Catalytic Effects
CO isotopic exchange reaction over Rh/Al_2O_3: nondissociative exchange on metallic Rh sites, 14:31529 (J;US)
RHODIUM COMPLEXES
Transition metal activation and functionalization of carbon-hydrogen bonds: Progress report, December 1, 1988–November 30, 1989, 14:31466 (R;US)
RHODOPSEUDOMONAS
Photosynthetic Reaction Centers
Long distance electron transfer, 14:32178 (BA;US)
RHODOSPIRILLUM
Protein Denaturation
Changes in Rhodospirillum rubrum cytochrome c_2 and subsequent renaturation: An ^{15}N NMR study, 14:32356 (J;US)
RIBONUCLEASE
See RNA-ASE
RIBONUCLEIC ACID
See RNA
RIBOSOMAL RNA
Amino Acid Sequence
Earliest phylogenetic branchings: comparing rRNA-based evolutionary trees inferred with various techniques, 14:32160 (BA;US)
Prokaryotes and archaebacteria are not monophyletic: rate invariant analysis of rRNA genes indicates that eukaryotes and eocytes form a monophyletic taxon, 14:32161 (BA;US)
Biological Evolution
Evolution of eukaryotic rRNA: constraints imposed by RNA interactions, 14:32150 (BA;US)
Evolving ribosome structure and function: rRNA and the translation mechanism, 14:32147 (BA;US)
Biological Functions
Role of RNA and protein in ribosome function: a review of early reconstitution studies and prospects for future studies, 14:32145 (BA;US)
Molecular Structure
New aspects of structure, assembly, evolution, and function of ribosomes, 14:32146 (BA;US)
Structure-Activity Relationships
Structures involved in Tetrahymena rRNA self-splicing and RNA enzyme activity, 14:32093 (BA;US)
Studies on the architecture and function of 16S rRNA, 14:32149 (BA;US)
RIBOSOMES
Amino Acid Sequence
Slippery runs, shifty stops, backward steps, and forward hops: -2, -1, +1, + 2, +5, and +6 ribosomal frameshifting, 14:32148 (BA;US)
Biological Evolution
New aspects of structure, assembly, evolution, and function of ribosomes, 14:32146 (BA;US)
Biological Functions
Modus operandi of the ribosome, 14:32151 (BA;US)

Peptide-specific ribosomes, genomic tags, and the origin of the genetic code, 14:32153 (BA;US)
Role of RNA and protein in ribosome function: a review of early reconstitution studies and prospects for future studies, 14:32145 (BA;US)

Molecular Structure
Approaches to the determination of the three-dimensional architecture of ribosomal particles, 14:32152 (BA;US)
Evolving ribosome structure and function: rRNA and the translation mechanism, 14:32147 (BA;US)
Role of RNA and protein in ribosome function: a review of early reconstitution studies and prospects for future studies, 14:32145 (BA;US)

RICHLAND FFTF REACTOR
See FFTF REACTOR

RIEMANN CURVATURE TENSOR
See RIEMANN SPACE

RIEMANN GEOMETRY
See RIEMANN SPACE

RIEMANN MANIFOLDS
See RIEMANN SPACE

RIEMANN METRIC
See RIEMANN SPACE

RIEMANN SPACE
Conformal Mapping
Fermionic center in the superconformal algebra on the supertorus, 14:32819 (R;US)

RIEMANN SPHERE
See RIEMANN SPACE

RING LASERS
Laser Cavities
Short-pulse intracavity Raman laser, 14:31639 (BA;US)

RINGS (STORAGE)
See STORAGE RINGS

RISA
See ALBUMINS

RISER CRACKING
See COAL LIQUEFACTION

RISK ANALYSIS
See RISK ASSESSMENT

RISK ASSESSMENT
Human Factors
Possible application of fuzzy set theory to radiation protection and risk assessment, 14:33006 (RA;AT)

RIVERS
See also COLUMBIA RIVER
DANUBE RIVER

Isotope Ratio
Environmental isotope-aided studies on river water and groundwater interaction in the region of Seoul and Taegu, 14:32060 (RA;XA)

Oil Spills
Development of an oil spill simulation model for the Saint-Lawrence River, 14:30304 (R;CA;In French)

RNA
See also MESSENGER-RNA
RIBOSOMAL RNA
TRANSFER RNA

Biochemical Reaction Kinetics
Evolution of eukaryotic rRNA: constraints imposed by RNA interactions, 14:32150 (BA;US)

Biological Evolution
In search of RNA ancestors, 14:32082 (BA;US)

Biological Functions
Evolution of catalytic function, 14:32078 (BA;US)

Molecular Structure
Evolution of the RNA coliphages: the role of secondary structures during RNA replication, 14:32108 (BA;US)
Improved parameters for prediction of RNA structure, 14:32092 (BA;US)

Structure-Activity Relationships
Characterization of two RNA-catalyzed RNA cleavage reactions, 14:32103 (BA;US)
Implications of intermolecularly catalyzed reactions by the Tetrahymena ribozyme, 14:32094 (BA;US)
Internal guide sequence and reaction specificity of group I self-splicing introns, 14:32095 (BA;US)
Reactions mediated by yeast mitochondrial group I and II introns, 14:32097 (BA;US)
Structural and ionic requirements for self-cleavage of virusoid RNAs and trans self-cleavage of viroid RNA, 14:32101 (BA;US)

RNA POLYMERASES
Biological Evolution
Nonenzymatic template-directed synthesis of information macromolecules, 14:32083 (BA;US)
Replication and evolution of short-chained RNA species replicated by Qβ replicase, 14:32106 (BA;US)

Enzyme Activity
Switch from transcription to replication of a negative-strand RNA virus, 14:32113 (BA;US)

Molecular Structure
Genetic dissection of an RNA enzyme, 14:32096 (BA;US)

RNA PROCESSING
Biological Pathways
Different small nuclear ribonucleoprotein particles are involved in different steps of splicing complex formation, 14:32105 (BA;US)

RNA-ASE
Chemical Composition
Characteristics of ribonuclease P from various organisms, 14:32099 (BA;US)

Molecular Structure
C-peptide helix from ribonuclease A considered as an autonomous folding unit, 14:32116 (BA;US)

Structure-Activity Relationships
Structure and catalytic function in ribonuclease P, 14:32100 (BA;US)

ROAD TRANSPORT
Environmental Impacts
Issues in environmental analysis. Transportation Research Record, 14:31102 (R;US)

Risk Assessment
The risks and consequences from the transport of low specific activity materials by truck, 14:30451 (R;US)

ROADS
Lighting Systems
Low pressure sodium roadway lighting, 14:31141 (R;CA)
Roadway lighting equipment management systems. Preliminary review: final report synopsis. [B] User standards for luminaire specifications, vol. 1, 14:31140 (R;CA)

Maintenance
Transportation planning and automated guideways. Transportation research record, 14:31103 (R;US)

ROBOTS
Equations Of Motion
Analysis and control of a three-degree-of-freedom robot platform, 14:31594 (R;US)

Navigation
The use of stereo optical flow fields in the determination of three-dimensional motion and stereo correspondence: Progress report, May 1988–April 1989, 14:31595 (R;US)

ROCK MECHANICS
Evaluation
Acoustic emissions during anelastic strain recovery of cores from deep boreholes, 14:32434 (R;US)
Relevance of partial saturation to the mechanical behavior of tuffs, 14:30581 (R;US)

ROCKS
See also IGNEOUS ROCKS
METAMORPHIC ROCKS

Geologic Structures
Site characterization and validation. Borehole radar investigations, Stage 1, 14:30609 (R;SE)

ROCKY MOUNTAIN REGION
See FEDERAL REGION VIII

RODS (CONTROL)
See CONTROL ELEMENTS

RODS (FUEL)
See FUEL RODS
ROENTGEN EQUIVALENT MAN
See DOSE EQUIVALENTS
ROOF BOLTS
Performance Testing
Procedural guide for roof bolt anchorage tests, 14:31685 (R;CA)
ROOFS
Evaluation
Roofing systems evaluation, 14:31089 (R;CA;In English and French)
Hazardous Materials
Health-hazard evaluation determination report No. 75-102-304, Sellers and Marquis Roofing Company, A. J. Shirk Roofing Company, Western Roofing Company, and the Quality Roofing Company; a joint venture, Kansas City, Missouri, 14:31960 (R;US)
Mathematical Models
Mathematical modeling of roof systems, 14:31057 (R;US)
Thermal Conductivity
Techniques for *in situ* determination of thermal resistance of lightweight board insulations, 14:31658 (J;US)
Thermal Testing
The Roof Research Center: A national user facility for thermal performance and durability of roofing systems: Users manual, 14:31072 (R;US)
ROTAMAK DEVICES
Plasma Confinement
Particle confinement in realistic 3D rotamak equilibria, 14:32892 (J;US)
ROTATIONAL BAND
See ROTATIONAL STATES
ROTATIONAL STATES
Cranking Model
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)
Eigenfunctions
Intermediate statistics of quasienergy spectrum and quantum localization of classical chaos, 14:32826 (R;SU;In Russian)
Pairing Interactions
Study of shape changes of rotating nuclei, 14:32699 (R;FR;In French)
Stochastic Processes
Intermediate statistics of quasienergy spectrum and quantum localization of classical chaos, 14:32826 (R;SU;In Russian)
ROTORS
Verification analysis of the toroidal accelerator rotor platform wind energy conversion system. Summary report, 14:30789 (R;US)
RUBBERS
Permeability
Study of nonsteady-state continuous membrane column for gas separation, 14:31438 (J;US)
RUBIDIUM BROMIDES
Surface Properties
Surface phonon modes of the RbBr(001) crystal surface by inelastic He-atom scattering, 14:31374 (J;US)
RUBIDIUM COMPOUNDS
See also RUBIDIUM BROMIDES
Separation Processes
Proton-ionizable crown compounds: transport of alkali and alkaline earth cations using proton-ionizable triazolo macrocycles, 14:31439 (J;US)
RUM JUNGLE PROJECT
Tailings
Rum Jungle tailings dam - chemical profile of the subsoil, 14:30620 (R;AU)
RUMEN
See STOMACH
RUNOFF
Environmental Impacts
Issues in environmental analysis. Transportation Research Record, 14:31102 (R;US)
RURAL AREAS
Mass Transit Systems
Analysis of four selected state-transportation coordinated efforts in social services and rural public transportation. Final report, 14:31099 (R;US)
Transportation Systems
Transportation planning and automated guideways. Transportation research record, 14:31103 (R;US)
RUTHENIUM 103
Radioecological Concentration
Measurements on internal contamination in Budapest due to the Chernobyl accident, 14:32019 (RA;AT)
RUTHENIUM 104 TARGET
Krypton 86 Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
RUTHENIUM COMPLEXES
Catalytic Effects
Transition metal activation and functionalization of carbon-hydrogen bonds: Progress report, December 1, 1988–November 30, 1989, 14:31466 (R;US)
Structural Chemical Analysis
Vibrational spectra and normal-coordinate analysis of tris(bipyridine)ruthenium(II), 14:31522 (J;US)
RUTHENIUM COMPOUNDS
See also RUTHENIUM OXIDES
Structural Chemical Analysis
High-pressure spectroscopic studies of ferrocene, nickelocene, and ruthenocene, 14:31503 (J;US)
RUTHENIUM OXIDES
Catalytic Effects
Polyelectrolyte-stabilized metal oxide hydrosols as catalysts for the photooxidation of water by zinc porphyrins, 14:31558 (J;US)
RWE-BAYERNWERK REACTOR
Radioactive Effluents
Radiological analysis of the upper Danube river system -a 20 years research programme, 14:32072 (RA;AT;In German)
RWE-BAYERNWERK-B REACTOR
See GUNDREMMINGEN-2 REACTOR
RWE-BAYERNWERK-C REACTOR
See GUNDREMMINGEN-3 REACTOR

S

S-1000 RESONANCES
See MESONS
SACCHAROMYCES
See also SACCHAROMYCES CEREVISIAE
Growth
Fermentability tests of sugars produced in the Solar Energy Research Institute's plug-flow reactor, 14:30658 (RA;US)
SACCHAROMYCES CEREVISIAE
Comparative Evaluations
Comparison of Saccharomyces cerevisiae and Candida shehatae for bioconversion of corn stover hydrolyzate to ethanol, 14:30670 (RA;US)
SAFETY (NUCLEAR)
See RADIATION PROTECTION
SAFETY (REACTOR)
See REACTOR SAFETY
SAFETY STANDARDS
Historical Aspects
Highlights in the evolution of radiation protection practices, 14:32764 (RA;AT)
SALAMANDERS
Dna Sequencing
Transcripts of newt satellite DNA self-cleave in vitro, 14:32102 (BA;US)
SALINE ZONE
See OIL SHALES

SALMON
Migration
Effects of variation in flow on distributions of northern squawfish in the Columbia River below McNary Dam, 14:30694 (RA;US)
Feasibility of reducing or controlling predation induced mortality of juvenile salmonids in Columbia River reservoirs, 14:30684 (RA;US)
Functional response of northern squawfish predation to salmonid prey density in McNary Tailrace, Columbia River, 14:30685 (RA;US)
Predation by northern squawfish, walleye, smallmouth bass, and channel catfish in a mainstem Columbia River reservoir. I. Feeding ecology during the salmonid smolt out-migration, 14:30680 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia River Reservoir: Part II. Consumption rates of northern squawfish, walleye, smallmouth bass, and channel catfish, 14:30681 (RA;US)
Simulation of predation by a resident fish on juvenile salmonids in a Columbia River Reservoir, 14:30690 (RA;US)
Mortality
Population dynamics of northern squawfish and potential predation on juvenile salmonids in a Columbia River reservoir, 14:30688 (RA;US)
User's guide for RESPRED: a model of predation by resident fish on juvenile salmonids in a Columbia River reservoir, 14:30698 (RA;US)
Predator-Prey Interactions
Gastric evacuation in smallmouth bass (Micropterus dolomieui), 14:30683 (RA;US)
Population dynamics of walleye and smallmouth bass and potential on salmonid smolts in John Day Reservoir, 14:30689 (RA;US)
Predation by resident fish on juvenile salmonids in a mainstem Columbia Reservoir: Part IV. Estimated total loss and mortality of juvenile salmonids to northern squawfish, walleye, and smallmouth bass, 14:30687 (RA;US)
SALTS
Isotachophoresis
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
Mass Spectroscopy
Capillary isotachophoresis mass spectrometry, 14:31403 (J;US)
SAMARIUM
Ion Exchange Chromatography
Rapid determination of burn-up of nuclear fuel - a possible approach, 14:31447 (J;US)
Liquid Column Chromatography
Rapid determination of burn-up of nuclear fuel - a possible approach, 14:31447 (J;US)
SAMARIUM 142
Energy Levels
$^{148}Gd(p,t)^{146}Gd$ reaction: Neutron states in ^{146}Gd, 14:32676 (J;US)
SAMARIUM 144 TARGET
Proton Reactions
$^{148}Gd(p,t)^{146}Gd$ reaction: Neutron states in ^{146}Gd, 14:32676 (J;US)
SAMPLERS
See also AIR SAMPLERS
Design
Fuel pool component sampler as an integral part of a direct assay waste characterization method, 14:30469 (RA;US)
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
Efficiency
Variation in capture efficiency of a beach seine for small fishes, 14:30693 (RA;US)
Uses
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
SANDIA LABORATORIES
Research Programs
Basic Energy Sciences Materials Sciences programs: FWP executive summaries, 14:31228 (R;US)
Comparison of laboratory performances, 14:32049 (J;US)
SANDSTONES
Diagenesis
Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)
Geology
Integrated reservoir assessment and characterization: Final report, October 1, 1985–September 30, 1988, 14:30293 (R;US)
Sorptive Properties
Surfactant loss: Effects of temperature, salinity, and wettability, 14:30292 (R;US)
SANITARY LANDFILLS
Land Pollution
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)
Land Pollution Control
Radio-frequency enhanced decontamination of soils contaminated with halogenated hydrocarbons, 14:31998 (R;US)
Leachates
Leachate treatment. January 1972-April 1989 (Citations from Pollution Abstracts). Report for January 1972-April 1989, 14:32000 (R;US)
Methane
Trace constituents in landfill gas. Task report on corrosion potential. Final report, May 1984-June 1985, 14:30652 (R;US)
Water Pollution
Installation restoration program. Phase 2. Confirmation/quantification stage 2, Moody Air Force Base, Georgia. Appendices. Volume 2. Final report, October 1986-November 1987, 14:32031 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)
SARCOMAS
See also OSTEOSARCOMAS
Nmr Imaging
Morphology of osteogenic and chondrogenic tumors examined by NMR imaging, 14:32313 (RA;DD;In German)
SASKATCHEWAN
Property Rights
Report on the terms of reference respecting the inquiry into certain aspects of the Surface Rights Acquisition and Compensation Act, and the board of arbitration for the province of Saskatchewan, 14:30307 (R;CA)
SAVANNAH RIVER PLANT
Chemical Effluents
F/H Effluent Treatment Facility ECWPF pilot test, 14:30538 (R;US)
Environmental Impacts
Dispersion of HT and HTO following an unplanned release of tritium to the atmosphere, 14:32957 (J;US)
Program Management
Wildlife management assistance report: Progress report, July 1, 1988–June 30, 1989, 14:32027 (R;US)
Radioactive Effluents
Residence time distributions for ETF pH adjustment system, 14:30539 (R;US)
Site Characterization
State of stress and the relation to tectonics in the central Savannah River area of South Carolina, 14:32429 (R;US)
SCANDIUM
Mass
Measurement of the mass of /sup 39/Sc, 14:32488 (R;AU)

SCANDIUM 45 TARGET
Photonuclear Reactions
Study on isomeric ratios in the /sup 45/Sc(γ,n)/sup 44mg/Sc and /sup 44/Ca(p,n)/sup 44mg/Sc reactions, 14:32666 (R;SU;In Russian)
SCANDIUM IONS
Hyperfine Structure
Laser-rf double-resonance measurements of the hyperfine structure in Sc ii, 14:32521 (J;US)
SCANNERS (IMAGE)
See IMAGE SCANNERS
SCATTERING
Momentum Transfer
Momentum distributions: An overview, 14:32835 (R;US)
SCAVENGING (ATMOSPHERIC)
See WASHOUT
SCINTILLATION CHAMBERS
See SCINTILLATION COUNTERS
SCINTILLATION COUNTERS
See also SCINTILLATOR-PHOTODIODE DETECTORS
SOLID SCINTILLATION DETECTORS
Specifications
Ballon-Borne experiments to study hard x-rays and gamma-rays from SN 1987 A, 14:31795 (RA;BR)
SCINTILLATION DETECTORS
See SCINTILLATION COUNTERS
SCINTILLATOR-PHOTODIODE DETECTORS
Design
A 1-D, hard x-ray pinhole camera for flash x-ray pulsed-power accelerators, 14:31869 (R;US)
SCLERA
See EYES
SCOTLAND
See UNITED KINGDOM
SCRAP METALS
Recycling
Recycling of iron and steel. State of the situation, 14:31152 (R;CA;In French)
SEA LEVEL
Modifications
Introduction to background materials for Workshop No. 1: Global climate change and its effects on California, 14:31971 (R;US)
SEABROOK-1 REACTOR
Risk Assessment
Safety Evaluation Report related to the operation of Seabrook Station, Units 1 and 2 (Docket Nos. 50-443 and 50-444), 14:30908 (R;US)
SEABROOK-2 REACTOR
Safety Evaluation Report related to the operation of Seabrook Station, Units 1 and 2 (Docket Nos. 50-443 and 50-444), 14:30908 (R;US)
SEALS
Evaluation
Issues pertinent to sealing of radioactive waste repositories in bedded salt formations, 14:30603 (R;US)
SEASONAL THERMAL ENERGY STORAGE
Aquifers
Seasonal heating and cooling through aquifer energy storage, 14:30942 (RA;CA;In English and French)
Computer Codes
A computer code for analyzing the performance of aquifer thermal energy storage systems, 14:30951 (RA;CA;In English and French)
Computerized Simulation
A computer code for analyzing the performance of aquifer thermal energy storage systems, 14:30951 (RA;CA;In English and French)
Heating of an office building using solar energy in combination with a heat pump and seasonal heat storage, 14:30950 (RA;CA;In English and French)
Low temperature thermal aquifer storage. A full scale experiment with the purpose of avoiding long term cooling of the subsurface environment, 14:30934 (RA;CA;In English and French)
Project for low-temperature storage of solar heat in Klippan, Sweden, 14:30959 (RA;CA;In English and French)
Cost Benefit Analysis
Seasonal heating and cooling through aquifer energy storage, 14:30942 (RA;CA;In English and French)
The feasibility of seasonal storage of excess heat for the district heating system at Almere, 14:30954 (RA;CA;In English and French)
Demonstration Programs
Aquifer heat storage technology in Sweden, 14:30932 (RA;CA;In English and in French)
Aquifer thermal energy storage experience with the Scarborough field trial, 14:30957 (RA;CA;In English and French)
Aquifer thermal energy storage experimental project in Italy, 14:30937 (RA;CA;In English and French)
Heat storage and heat pumps on aquifer. Two case studies, 14:30931 (RA;CA;In English and French)
Energy Efficiency
Brunkeberg aquifer thermal storage in central Stockholm, 14:30935 (RA;CA;In English and French)
Feasibility Studies
Aquifer heat storage technology in Sweden, 14:30932 (RA;CA;In English and in French)
Aquifer thermal energy storage experimental project in Italy, 14:30937 (RA;CA;In English and French)
Heat storage and heat pumps on aquifer. Two case studies, 14:30931 (RA;CA;In English and French)
Potential for seasonal storage of industrial surplus heat, 14:30939 (RA;CA;In English and French)
Project for low-temperature storage of solar heat in Klippan, Sweden, 14:30959 (RA;CA;In English and French)
Project of thermal storage in deep aquifer (Sarcelles, France). Simulation of the hydraulic and thermal behaviour of the system, 14:30958 (RA;CA;In English and French)
Seasonal heating and cooling through aquifer energy storage, 14:30942 (RA;CA;In English and French)
The feasibility of seasonal storage of excess heat for the district heating system at Almere, 14:30954 (RA;CA;In English and French)
Optimization
Groundwater heat pumps in combination with low-temperature natural heat sources. Economical and technical aspects, 14:30953 (RA;CA;In English and French)
Performance Testing
A computer code for analyzing the performance of aquifer thermal energy storage systems, 14:30951 (RA;CA;In English and French)
Pilot Plants
Project of thermal storage in deep aquifer (Sarcelles, France). Technical data and economic analysis, 14:30940 (RA;CA;In English and French)
Prototype of underground high-temperature heat storage in Thiverval-Grignon (France), 14:30933 (RA;CA;In French)
Research Programs
Aquifer thermal energy storage in the United States, 14:30945 (RA;CA;In English and French)
Simulation
Project of thermal storage in deep aquifer (Sarcelles, France). Simulation of the hydraulic and thermal behaviour of the system, 14:30958 (RA;CA;In English and French)
Solar Heating
Project for low-temperature storage of solar heat in Klippan, Sweden, 14:30959 (RA;CA;In English and French)
Technology Assessment
Aquifer thermal energy storage in the United States, 14:30945 (RA;CA;In English and French)
SEAWATER
Quantitative Chemical Analysis
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)
SEBACEOUS GLANDS
See SKIN

SECONDARY BATTERIES
See ELECTRIC BATTERIES
SECONDARY RECOVERY
See ENHANCED RECOVERY
SEDIMENTARY BASINS
Geochemistry
Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)
Petrography
Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)
Sandstones
Genesis and migration of petroleum in selected Dogger beta deposits of the Gifhorn trough: Interdependences between hydrocarbon genesis and sandstone diagenesis, 14:30287 (R;DE;In German)
SEDIMENTATION
Measuring Instruments
Development of nuclear suspended sediment flux gauge HDD-1, 14:31815 (RA;XA)
SEDIMENTS
Biological Effects
Biological testing of sediment for the Olympia Harbor Navigation Improvement Project, 1988: Geoduck, amphipod, and echinoderm bioassays, 14:32046 (R;US)
Evaluation
A review of near field seawater-sediment interactions with application to the subseabed disposal of nuclear waste, 14:30578 (R;US)
Quantitative Chemical Analysis
Geochemistry and mobility of the lanthanides in marine sediments, 14:32051 (R;GB)
Rare Earths
Geochemistry and mobility of the lanthanides in marine sediments, 14:32051 (R;GB)
SEISMIC EVENTS
See also EARTHQUAKES
Forecasting
State of stress and the relation to tectonics in the central Savannah River area of South Carolina, 14:32429 (R;US)
Mathematical Models
Seismic coupling of nuclear explosions: Volume 1, 14:31904 (R;US)
SEISMIC SOURCES
Performance
Feasibility study for a periodic downhole seismic source, 14:31609 (R;US)
SEISMOLOGY
Barc
Research and development activities of the seismology section for the period January 1986 to December 1987, 14:32418 (R;IN)
Progress Report
Research and development activities of the seismology section for the period January 1986 to December 1987, 14:32418 (R;IN)
SELENITES
Activation Analysis
Determination of selenium metabolites in biological fluids using instrumental and molecular neutron activation analysis, 14:31459 (J;US)
SELENIUM
Determination of selenium metabolites in biological fluids using instrumental and molecular neutron activation analysis, 14:31459 (J;US)
Cadmium
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Chemical Bonds
Bonding of Se and ZnSe to the Si(100) surface, 14:31379 (J;US)
Chromium
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Deposition
Bonding of Se and ZnSe to the Si(100) surface, 14:31379 (J;US)
Magnetic Semiconductors
Theory of photon-drag effect in bulk magnetic semiconductors, 14:32804 (R;BR)
Photochemical Reactions
Studies of polycrystalline n-GaAs junctions: effects of metal ion chemisorption on the photoelectrochemical properties of n-GaAs/KOH-$Se^{-/2-}$, n-GaAs/CH_3CH-ferrocene$^{+/0}$, and n-GaAs/Au interfaces, 14:31524 (J;US)
SEMICONDUCTOR COUNTERS
See SEMICONDUCTOR DETECTORS
SEMICONDUCTOR DETECTORS
See also SI SEMICONDUCTOR DETECTORS
Plutonium
25 years of in vivo measurements of transuranes at KFK, 14:31844 (RA;AT;In German)
SEMICONDUCTOR DEVICES
See also SEMICONDUCTOR DIODES
SEMICONDUCTOR LASERS
SEMICONDUCTOR SWITCHES
Fabrication
Chemically amplified laser direct-writing of aluminum, 14:31341 (BA;US)
Enhanced photochemistry on metal surfaces, 14:31234 (BA;US)
Laser-initiated chemical vapor etching of ceramics, 14:31289 (BA;US)
Laser-written metallization patterns for solar cell applications, 14:31340 (BA;US)
Plasma initiated laser etching and deposition of semiconductor materials, 14:31343 (BA;US)
Recent developments in the methods and applications of reactive laser-direct-patterning techniques, 14:31339 (BA;US)
Selective photochemical dry etching of III-V compound semiconductors, 14:31344 (BA;US)
Laser Radiation
Laser-initiated chemical vapor etching of ceramics, 14:31289 (BA;US)
SEMICONDUCTOR DIODES
Geometry
Semiconductor laser-diode-pumped solid-state lasers, status and future, 14:31644 (BA;US)
SEMICONDUCTOR LASERS
Etching
Reactive ion etching of laser structures, 14:31635 (BA;US)
Geometry
Semiconductor laser-diode-pumped solid-state lasers, status and future, 14:31644 (BA;US)
Laser Materials
Cesium laser-excited optical filter, 14:31643 (BA;US)
Optical Properties
High-brightness diode lasers for blue-green applications. Interim technical report, 1 July 1987-31 December 1988, 14:31627 (R;US)
Performance
Cesium laser-excited optical filter, 14:31643 (BA;US)
SEMICONDUCTOR MATERIALS
See also MAGNETIC SEMICONDUCTORS
Crystal Structure
Proceedings of the 4. Brazilian School of Semiconductor Physics, 14:32787 (R;BR;In Portuguese)
Electric Conductivity
Numerical simulations of hopping conductivity using nonflat densities of states, 14:32814 (J;US)
Preparation and characterization of ohmic contacts to n-GaAs and p-GaSb, 14:31208 (RA;BR)
Etching
Selective photochemical dry etching of III-V compound semiconductors, 14:31344 (BA;US)

Meetings
Proceedings of the 4. Brazilian School of Semiconductor Physics, 14:32787 (R;BR;In Portuguese)
Metallography
Laser-written metallization patterns for solar cell applications, 14:31340 (BA;US)
Recent developments in the methods and applications of reactive laser-direct-patterning techniques, 14:31339 (BA;US)
Microstructure
The use of heteroepitaxy in the fabrication of bicrystals for the study of grain boundary structure, 14:31298 (J;US)
Nuclear Engineering
Proceedings of the 4. Brazilian School of Semiconductor Physics, 14:32787 (R;BR;In Portuguese)
Photochemistry
Enhanced photochemistry on metal surfaces, 14:31234 (BA;US)
Photoelectrochemistry and photochemistry of sensitized semiconductor surfaces, 14:31293 (BA;US)
Physical Properties
Proceedings of the 4. Brazilian School of Semiconductor Physics, 14:32787 (R;BR;In Portuguese)
Plasmons
Plasmon excitations in some II - VI and IV -VI semiconductors, 14:32794 (RA;BR)
Processing
Plasma initiated laser etching and deposition of semiconductor materials, 14:31343 (BA;US)
Sample Preparation
Preparation and characterization of ohmic contacts to n-GaAs and p-GaSb, 14:31208 (RA;BR)
X-Ray Diffraction
Preparation and characterization of ohmic contacts to n-GaAs and p-GaSb, 14:31208 (RA;BR)
SEMICONDUCTOR SWITCHES
Design
A novel TR [transmit/receive] switch utilizing a distributed amplifier, 14:31870 (R;US)
Photoconductive semiconductor switch (PCSS) recovery, 14:31672 (R;US)
Operation
Closing photoconductive semiconductor switches, 14:31673 (R;US)
SENIOR CENTERS
See PUBLIC BUILDINGS
SENSIBLE HEAT STORAGE
Computerized Simulation
Comparison of long-term aquifer thermal energy storage experiments to 3-D computer simulations, 14:30930 (RA;CA;In English and French)
Demonstration Programs
Thermal energy storage programme in Sweden, 14:30987 (RA;CA;In English and French)
Underground heat storage in France. Present stage development and future prospects, 14:30948 (RA;CA;In English and French)
Feasibility Studies
Review and findings of the Second EX-IEA Workshop on Solar Assisted Heatpumps Systems with Ground Coupled Storage, 14:30947 (RA;CA;In English and French)
Mathematical Models
Comparison of long-term aquifer thermal energy storage experiments to 3-D computer simulations, 14:30930 (RA;CA;In English and French)
Meetings
Review and findings of the Second EX-IEA Workshop on Solar Assisted Heatpumps Systems with Ground Coupled Storage, 14:30947 (RA;CA;In English and French)
Monitoring
Design and implementation of a heated water injection experiment in an unconsolidated aquifer, 14:30956 (RA;CA;In English and French)
Technology Assessment
Thermal energy storage programme in Sweden, 14:30987 (RA;CA;In English and French)
Underground heat storage in France. Present stage development and future prospects, 14:30948 (RA;CA;In English and French)
SEPARATION PROCESSES
See also DISTILLATION
ISOTOPE SEPARATION
LEACHING
PRECIPITATION
Evaluation
Iodine emission from separations processes and flowsheets for improved emission control, 14:30562 (R;US)
Meetings
Fifth symposium on separation science and technology for energy applications, 14:31396 (B;US)
Performance Testing
F/H Effluent Treatment Facility ECWPF pilot test, 14:30538 (R;US)
SEQUESTRENE
See EDTA
SERI
See SOLAR ENERGY RESEARCH INSTITUTE
SERPUKHOV SYNCHROTRON
Biological Shielding
Spectral and angular distributions of charged particles outside biological shielding of the 70 GeV Serpukhov accelerator, 14:31742 (R;SU;In Russian)
SERPUKHOV TEVATRON
Construction
Status and development of Serpukhov tevatron, 14:31787 (R;SU;In Russian)
SERUM (BLOOD)
See BLOOD SERUM
SEWAGE SLUDGE
Anaerobic Digestion
Methane from partially digested sewage sludge. Final report, 14:30651 (R;US)
Contamination
Activity concentration in the discharge of a sewage purification plant, 14:30918 (RA;AT;In German)
Chernobyl - radioactivity in sludge produced in wastewater treatment plants, 14:30924 (R;SE;In Swedish)
SHALE MINING
See OIL SHALE MINING
SHALE OIL
See also SHALE OIL FRACTIONS
Chemical Composition
Dependence of the yield and properties of semicoking oils on the mineral content and composition of oil shales, 14:30388 (RA;CN)
Coking
New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)
Desulfurization
Concentration and removal of nitrogen and sulfur containing compounds from organic liquids phases using electrochemically reversed chemical complexation, 14:30268 (J;US)
Gasification
Utilization of high-sulfur shale oil in power plant integrated with gasification system, 14:30402 (RA;CN)
Hydrogenation
Preliminary study on hydrotreating of a high sulfur content shale oil, 14:30361 (RA;CN)
Production
Ideas on the development of Maoming oil shale and shale oil industry, 14:30415 (RA;CN)
Refining
Unocal Corporation's commercial experience in upgrading shale oil to produce a high quality syncrude, 14:30362 (RA;CN)
Upgrading Julia Creek shale oil - syncrude or fully refined products, 14:30363 (RA;CN)
Upgrading of shale oil by an ebullated-bed reactor, 14:30364 (RA;CN)
Structural Chemical Analysis
Characterization of flash pyrolysis products from Green River shale, 14:30347 (RA;CN)

Comparison of Fischer assay shale oils produced from different oil shales, 14:30389 (RA;CN)

SHALE OIL FRACTIONS
Chemical Composition
Preliminary study on hydrotreating of a high sulfur content shale oil, 14:30361 (RA;CN)
Coking
Kinetics of the cracking and coking of oil shale vapors and their relevance to the processing of Australian oil shales, 14:30348 (RA;CN)
Refining
New scheme for upgrading Fushun shale oil, 14:30365 (RA;CN)
Structural Chemical Analysis
Application of pyrolysis gas chromatography to examination of behavior in retorting of various oil shales, 14:30386 (RA;CN)
Isothermal pyrolysis gas chromatography for study of hydrocarbon formation kinetics from kerogens, 14:30345 (RA;CN)
Thermal Cracking
Kinetics of the cracking and coking of oil shale vapors and their relevance to the processing of Australian oil shales, 14:30348 (RA;CN)

SHALES
Chemical Properties
Acid mine drainage potential of raw, retorted, and combusted Eastern oil shale: Final report, 14:30420 (R;US)

SHF RADIATION
See RADIOWAVE RADIATION

SHIELDING
See also BIOLOGICAL SHIELDING
Physical Radiation Effects
Shield optimization program: Part 5, A hydrodynamic comparison using HULL and PUFF-TFT for a one-dimensional aluminum slab, 14:33029 (R;US)
Three-Dimensional Calculations
Gamma shielding by buildings, 14:31600 (RA;AT;In German)

SHIPMENT
See TRANSPORT

SHOCK ABSORBERS
Performance Testing
UF-6 cylinder overpack phenolic foam drop tests, 14:30448 (R;US)

SHORT CIRCUITS
See ELECTRICAL FAULTS

SHORT ROTATION CULTIVATION
Evaluation
Energy forest east. Progress report 1987-1988, 14:30740 (R;SE;In Swedish)
Energy forest south. Progress report 1987-1988, 14:30739 (R;SE;In Swedish)
Sweden
Energy forest east. Progress report 1987-1988, 14:30740 (R;SE;In Swedish)

SHOTFIRING
See EXPLOSIVE FRACTURING

SHOWER COUNTERS
Computer Calculations
CALOR89: The code system for calorimeter analysis and design, 14:31808 (R;US)
Cryogenics
Hermeticity of three cryogenic calorimeter geometries, 14:31811 (R;US)
Design
Detectors for the Superconducting Super Collider, design concepts, and simulation, 14:31807 (R;US)
Detectors for the superconducting super collider, design concepts, and simulation, 14:31849 (R;US)
The Soudan 2 proton decay experiment, 14:31801 (R;US)
Trigger Circuits
A calorimeter software trigger for the Mark II detector at SLC [Stanford Linear Collider], 14:31853 (R;US)

SI SEMICONDUCTOR DETECTORS
Design
Solid-state nuclear detectors for monitoring low levels of tritium, 14:32956 (J;US)

SIALON
See ALUMINIUM OXIDES
SILICON NITRIDES

SIGMA BARYONS
Mass Formulae
Hyperon resonances in the chiral bag model, 14:32612 (J;US)

SIGMA C-2450 BARYONS
Detection
Observation of $\Sigma_c^0 \rightarrow \Lambda_c^+ \pi^-$ decays, 14:32572 (J;US)

SIGMA-2430 RESONANCES
See SIGMA C-2450 BARYONS

SILANES
Performance
High-rate deposition of hydrogenated amorphous silicon films and devices, 14:30745 (J;US)
Photochemistry
Photophysics of the phases of poly(di-n-hexylsilane), 14:31557 (J;US)

SILICA
Performance
Silver-coated fumed silica as a substrate material for surface-enhanced raman scattering, 14:31409 (J;US)
Surface Properties
Topological and bonding defects in vitreous silica surfaces, 14:31354 (J;US)

SILICA GEL
Sorptive Properties
Surfactant loss: Effects of temperature, salinity, and wettability, 14:30292 (R;US)

SILICEOUS ROCK
See SANDSTONES

SILICON
Chemical Bonds
Bonding of Se and ZnSe to the Si(100) surface, 14:31379 (J;US)
Chemical Shift
Bonding of Se and ZnSe to the Si(100) surface, 14:31379 (J;US)
Chemical Vapor Deposition
Plasma deposition of hydrogenated amorphous silicon films, 14:30744 (J;US)
Window cleaning and fluorine incorporation by XeF_2 in photochemical vapor deposition, 14:31679 (J;US)
Contamination
Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)
Crystal Defects
Microscopic models for (Au-Au) and (Pt-Pt) pair complexes in silicon, 14:32790 (RA;BR)
Crystal Growth
Thermal-capillary model with axisymmetric fluid flow for analysis of Czochralski crystal growth of high Prandtl number materials: Final report, 14:31337 (R;US)
Deposition
High-rate deposition of hydrogenated amorphous silicon films and devices, 14:30745 (J;US)
Electronic Structure
Microscopic models for (Au-Au) and (Pt-Pt) pair complexes in silicon, 14:32790 (RA;BR)
Fabrication
Fabrication of isotopic heterostructures and epitaxial thin films by ion beam deposition, 14:31346 (BA;US)
Impurities
Breathing-mode lattice relaxation accompanying emission and capture by deep electronic levels in silicon, 14:31365 (J;US)
Pressure dependence of deep electronic levels in semiconductors: Phosphorus-vacancy pair (or Si *E* center) and divacancy in silicon, 14:31373 (J;US)
Integrated Circuits
Laser processing, 14:31345 (BA;US)
Interferometry
Interferometric measurement of the pressure-enhanced crystallization rate of amorphous Si, 14:31361 (J;US)
Ion Implantation
Vibrational spectra of hydrogen containing centers in crystalline silicon, 14:32799 (R;SU;In Russian)

Mass Spectroscopy
Molecular beam studies of silicon etching by F/sub 2/, 14:31347 (BA;US)
Multiple Scattering
Microscopic models for (Au-Au) and (Pt-Pt) pair complexes in silicon, 14:32790 (RA;BR)
Phase Transformations
Observation of phase transitions on the (111) and (100) surfaces of Si near 1000 K with He atom diffraction, 14:31355 (J;US)
Photoconductivity
Saturation behavior of silicon Auston switches, 14:31884 (J;US)
Radiation Heating
Molecular beam studies of silicon etching by F/sub 2/, 14:31347 (BA;US)
Substrates
Magnetotransport properties of epitaxial SnAl/sub x/Ga/sub 1-x/As grow on Si by matalorganic vapor phase epitaxy (MOVPE), 14:32789 (RA;BR)
Surface Properties
Observation of phase transitions on the (111) and (100) surfaces of Si near 1000 K with He atom diffraction, 14:31355 (J;US)
Vapor Deposited Coatings
Thin-film deposition by a new laser ablation and plasma hybrid technique, 14:31359 (J;US)

SILICON 28 REACTIONS
Quasi-Elastic Scattering
Contribution of nucleon transfer to the elastic scattering of $^{28}Si+^{58,64}Ni$ near the Coulomb barrier, 14:32667 (J;US)

SILICON 30
Energy Beam Deposition
Fabrication of isotopic heterostructures and epitaxial thin films by ion beam deposition, 14:31346 (BA;US)

SILICON ALLOYS
Electronic Structure
Electronic structure of [110] Si-Ge thin-layer superlattices, 14:31358 (J;US)

SILICON CARBIDES
Cavitation
Characterization of pore evolution in ceramics during creep failure and densification, 14:31277 (R;US)
Erosion
Erosion of Al and Al/SiC, 14:31269 (R;US)
Neutron Diffraction
Application of neutron diffraction to the measurement of internal residual strain in the constituents of advanced composites, 14:31316 (R;US)

SILICON COMPOUNDS
See also SILANES
SILICON CARBIDES
SILICON NITRIDES
SILICON OXIDES
Crystal Structure
Crystal structures of $(MeC_5H_4)_4U_2(\mu\text{-}NR)_2$. Unsymmetrical bridging, R = Ph, and symmetrical bridging, R = $SiMe_3$, organoimide ligands in organoactinide compounds, 14:31578 (J;US)

SILICON HYDRIDES
See SILANES

SILICON NITRIDES
Dielectric Properties
Dielectric measurements of selected ceramic materials at 245 ghz, 14:31267 (R;US)
Nmr Imaging
Development of magnetic resonance imaging technology for imaging binder distribution in ceramics, 14:31272 (R;US)

SILICON OXIDES
See also QUARTZ
SILICA
Chemical Reactions
Electrochemical reactions in submerged arc welding with SiO_2-CaO-CaF_2 fluxes with high and low silica contents, 14:31274 (R;US)
Physical Radiation Effects
Defect generation in silicon dioxide from synchrotron radiation below 41 eV, 14:31351 (J;US)
Submerged Arc Welding
Electrochemical transport of manganese between the flux and the weld metal in submerged arc welding, 14:31275 (R;US)

SILICON SEMICONDUCTOR DETECTORS
See SI SEMICONDUCTOR DETECTORS

SILICONES
Permeability
Study of nonsteady-state continuous membrane column for gas separation, 14:31438 (J;US)

SILVER
Chemisorption
Adsorbed layer and multilayer materials: The energetics and bonding of Pd and Ag on Nb(001) and Nb(110), 14:31258 (J;US)
Coster-Kronig Transitions
Coster-Kronig yields in silver measured with synchrotron radiation, 14:32528 (J;US)
Interfaces
High-resolution electron microscopy of metal/ceramic interfaces, 14:31186 (R;US)
Performance
Silver-coated fumed silica as a substrate material for surface-enhanced raman scattering, 14:31409 (J;US)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
Sorptive Properties
Surface plasmon polariton enhancement of Raman scattering in Kretschmann geometry, 14:31462 (J;US)
Total Cross Sections
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
X Radiation
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)

SILVER 107 TARGET
Proton Reactions
Baryon production in the central region of ultrarelativistic heavy-ion collisions, 14:32745 (J;US)

SILVER ALLOYS
Solution Heat
Alloy models with the embedded-atom method, 14:31257 (J;US)

SILVER COMPOUNDS
Solvent Extraction
Selective extraction of Cu^{2+} and Ag^{+} ions from sulfuric acid by synergistic combinations of tetradentate thia macrocycles with didodecylnaphthalene sulfonic acid, 14:31417 (J;US)

SIMS
See MASS SPECTROSCOPY

SINGLE-PARTICLE MODEL
Electrons
Landau levels of the two-dimensional electron systems in the corbino geometry, 14:32503 (RA;BR)
Two-Dimensional Calculations
Landau levels of the two-dimensional electron systems in the corbino geometry, 14:32503 (RA;BR)

SITE CHARACTERIZATION
Low-Level Waste Ocean Disposal Program final report: Site characterization of the Pacific Study Area, West Coast, Northern Site (W-N), 14:30577 (R;US)

SITE SURVEYS
Tracer Techniques
Recommendations for the determination of migration parameters by field experiments (tracer tests), 14:30885 (R;DD;In German)

SITES (REACTOR)
See REACTOR SITES

SKELETAL DISEASES
See also OSTEOSARCOMAS
Computerized Tomography
Indications and limits of CT from the orthopaedist's point of view, 14:32326 (RA;DD;In German)
Gadolinium Complexes
Value of Gd-DTPA in NMR imaging of inflammatory and neoplastic skeletal diseases, 14:32312 (RA;DD;In German)

Nmr Imaging
Comparison of NMR imaging and scintigraphic findings in malignant bone tumors, 14:32315 (RA;DD;In German)
MR tissue characterization in the follow-up of primary musculoskeletal tumors, 14:32329 (RA;DD)
Nuclear magnetic resonance imaging in chronic hemodialysis associated musculoskeletal amyloidosis, 14:32328 (RA;DD)
Value of Gd-DTPA in NMR imaging of inflammatory and neoplastic skeletal diseases, 14:32312 (RA;DD;In German)

Sarcomas
Morphology of osteogenic and chondrogenic tumors examined by NMR imaging, 14:32313 (RA;DD;In German)

Scintiscanning
Comparison of NMR imaging and scintigraphic findings in malignant bone tumors, 14:32315 (RA;DD;In German)

SKELETON
See also BONE JOINTS
FEMUR
SKULL
VERTEBRAE

Computerized Tomography
Comparison of MRT and CT in malignant bone tumors, 14:32314 (RA;DD;In German)
Diagnosis of skeleton and soft parts by CT and MRT, 14:32325 (RA;DD;In German)
Diagnosis of skeleton and soft tissues by CT and MRT, 14:32309 (RA;DD;In German)
New developments in measuring bone density by quantitative CT, 14:32339 (RA;DD;In German)

Density
New developments in measuring bone density by quantitative CT, 14:32339 (RA;DD;In German)

Nmr Imaging
Comparison of MRT and CT in malignant bone tumors, 14:32314 (RA;DD;In German)
Diagnosis of skeleton and soft parts by CT and MRT, 14:32325 (RA;DD;In German)
Diagnosis of skeleton and soft tissues by CT and MRT, 14:32309 (RA;DD;In German)

Quantitative Chemical Analysis
Trace element determinations with synchrotron-induced x-ray emission, 14:31463 (J;US)

Size
Use of diagnostic bones to identify and estimate original lengths of ingested prey fishes, 14:30692 (RA;US)

SKIN
Side Effects
New trends in skin protection from ionizing radiations, 14:32374 (RA;SU;In Russian)

SKULL
Computerized Tomography
Comparison of CT and MRT in intracranial inflammations and infections, 14:32336 (RA;DD;In German)
MRT versus CT in tumors of skull base and lower brain stem, 14:32303 (RA;DD;In German)
Role of computer tomography in the diagnostics of some diseases of the orbit, 14:32318 (RA;DD)

Eyes
Role of computer tomography in the diagnostics of some diseases of the orbit, 14:32318 (RA;DD)

Nmr Imaging
Comparison of CT and MRT in intracranial inflammations and infections, 14:32336 (RA;DD;In German)
MRT versus CT in tumors of skull base and lower brain stem, 14:32303 (RA;DD;In German)

Sinuses
Radiation burden in X-ray examinations of facial skull, 14:32351 (RA;AT;In German)

X-Ray Radiography
Radiation burden in X-ray examinations of facial skull, 14:32351 (RA;AT;In German)

SKYRMIONS
See SOLITONS

SLATER DETERMINANT
See SLATER METHOD

SLATER INTEGRALS
See SLATER METHOD

SLATER METHOD
Analytical evaluation of multicenter molecular integrals over Slater-type orbitals using expanded Loewdin alpha functions, 14:32483 (R;US)

SLATER ORBITALS
See SLATER METHOD

SLC
See STANFORD LINEAR COLLIDER

SLOW NEUTRONS
Diffusion
Study of cooperative processes in polymer gels by the method of slow neutron transmission, 14:32800 (R;SU;In Russian)

Gels
Study of cooperative processes in polymer gels by the method of slow neutron transmission, 14:32800 (R;SU;In Russian)

SLOWDOWN
See SLOWING-DOWN

SLOWING-DOWN
Computer Calculations
Review of unresolved resonance treatments in multigroup processing computer codes, 14:30862 (R;BR;In Portuguese)

Group Constants
Review of unresolved resonance treatments in multigroup processing computer codes, 14:30862 (R;BR;In Portuguese)

Resonance Escape Probability
Review of unresolved resonance treatments in multigroup processing computer codes, 14:30862 (R;BR;In Portuguese)

SLUDGES
See also SEWAGE SLUDGE

Encapsulation
CEGB experience in immobilizing radioactive resins, sludges, and related wastes, 14:30479 (RA;US)

Waste Disposal
Liner-waste compatibility studies for coal-fired power plants, 14:31112 (R;US)

SLUGS (FUEL)
See FUEL RODS

SLURRIES
Compressibility
Filtration behavior of slurries with varying compressibilities, 14:31456 (J;US)

Filtration
Filtration behavior of slurries with varying compressibilities, 14:31456 (J;US)

Viscosity
Lowering kraft black liquor viscosity of ultrafiltration, 14:31436 (J;US)

SMALL-SCALE HYDROELECTRIC POWER PLANTS
Meetings
Small hydro '88. An international conference and trade show. Proceedings, vol. 1, 14:30676 (R;CA)

Modular Structures
Report on modular hydropower demonstration, 14:30677 (R;US)

SMOG
Air Pollution
Validation testing of new mechanisms with outdoor chamber data. Volume 3: calculation of photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31941 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 4: appendixes to photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31942 (R;US)

Air Pollution Monitors
Validation testing of new mechanisms with outdoor chamber data, 14:31938 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 1: comparison of CB4 and CAL mechanisms. Final report, April 1986-September 1988, 14:31939 (R;US)

Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)

SMOKES
Fuels combustion research. Final technical report, 1 October 1985-30 September 1988, 14:31579 (R;US)

Air-Water Interactions
Response of the upper ocean to a large summertime injection of smoke in the atmosphere. Final report, 14:31898 (R;US)

SNOW
Backscattering
The effects of snow on landmarks in K_u band SAR [Synthetic Aperture Radar] images, 14:31866 (R;US)

SODIUM
Adiabatic Processes
Thermodynamics of metallic solids and fluids from molecular dynamics, 14:31233 (BA;US)

Atoms
R-f spectroscopy of trapped neutral atoms, 14:32487 (R;US)

SODIUM CHLORIDES
Diffusion
Ternary mutual diffusion coefficients of NaCl-$SrCl_2$-H_2O at 25°C. 2. Total concentrations of 2.0 and 3.0 mol×dm^{-3}, 14:31532 (J;US)

SODIUM CITRATES
See SODIUM COMPOUNDS

SODIUM COMPLEXES
Sorptive Properties
Dynamics of molecular hydrogen adsorbed in CoNa-A zeolite, 14:31545 (J;US)

SODIUM COMPOUNDS
See also SODIUM CHLORIDES
SODIUM NITRATES
SODIUM SULFATES

Chemical Reactions
Probing metal cluster formation in NaY zeolite by ^{129}Xe NMR, 14:31508 (J;US)

Ion Exchange
Multicomponent fixed-bed ion exchange: verification of equilibrium coherence theory, 14:31442 (J;US)

Separation Processes
Proton-ionizable crown compounds: transport of alkali and alkaline earth cations using proton-ionizable triazolo macrocycles, 14:31439 (J;US)

SODIUM IODIDE DETECTORS
See NAI DETECTORS

SODIUM LAURYL SULFATES
See SODIUM COMPOUNDS

SODIUM MINERALS
See MINERALS

SODIUM NITRATES
Leaching
A process for solidifying sodium nitrate waste in polyethylene, 14:30454 (R;US)

SODIUM SULFATES
Adsorption
Surfactant loss: Effects of temperature, salinity, and wettability, 14:30292 (R;US)

SODIUM-SULFUR BATTERIES
Electrodes
Na- and S-activity measurements using glass-membrane reference electrodes/sensors, 14:31052 (BA;US)

Electrolytes
Beta alumina failures in sodium/sulfur batteries, 14:30969 (BA;US)

SOIL CHEMISTRY
Modifications
The effect of nitrogen accumulation and nitrification on soil chemical properties in alder forests, 14:30701 (R;US)

SOILS
Radiation burden of soil and vegetation in South Tyrol, Italy, after the Chernobyl accident, 14:32020 (RA;AT;In German)

Acidification
The effect of nitrogen accumulation and nitrification on soil chemical properties in alder forests, 14:30701 (R;US)

Chemical Analysis
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)

Contamination
Calculation on free-in-air kermas and effective dose equivalents from radioisotopes deposited on soil, 14:32767 (RA;AT)
Chernobyl - radioactivity in sludge produced in wastewater treatment plants, 14:30924 (R;SE;In Swedish)
Correlation between thorium concentrations in soil and gamma readings in FUSRAP site in New Jersey, 14:32024 (J;US)

Field Tests
Field method for detemining thorium-230 in soils, 14:30627 (R;US)

Hydraulic Conductivity
Gamma ray attenuation as a method to determine the water infiltration and redistribution parameters in soil, 14:31814 (RA;BR)

In-Situ Processing
In situ vitrification - a status of the technology, 14:30514 (RA;US)

Radionuclide Migration
Prediction of radiation effects from proposed low-level waste disposal sites in Turkey, 14:32023 (J;US)

Radon 222
Investigations on radon exhalation rates of the soil, 14:32010 (RA;AT;In German)

Revegetation
An analysis of soil and surface properties which affect infiltration and runoff on mined lands, Centre County, Pennsylvania, 14:32025 (R;US)

Sorptive Properties
Cadmium and manganese sorption by soil macropore linings and fillings, 14:32005 (J;US)

Sulfates
Sulphate stores and sulphate adsorption capacity of the spodic B horizon of Swedish forest soils, 14:32003 (R;SE)

Water Influx
Gamma ray attenuation as a method to determine the water infiltration and redistribution parameters in soil, 14:31814 (RA;BR)

SOLAR ACTIVITY
See also SOLAR RADIO BURSTS
Solar-Geophysical Data Number 438, February 1981. Part 2 (comprehensive reports). Data for August 1980 and miscellanea, 14:32461 (R;US)

SOLAR CELLS
See also ALUMINIUM ARSENIDE SOLAR CELLS
GALLIUM ARSENIDE SOLAR CELLS

Fabrication
Window cleaning and fluorine incorporation by XeF_2 in photochemical vapor deposition, 14:31679 (J;US)

Organic Semiconductors
Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)

SOLAR COLLECTORS
See also FLAT PLATE COLLECTORS

Concentration Ratio
Performance of highly concentrating mirror collectors and collector systems, 14:30756 (R;DE;In German)

Heat Storage
Experimental investigation of regulating systems for combinations of solar collectors and heat pumps, 14:30750 (R;DK;In Danish)

Solar Concentrators
Performance of highly concentrating mirror collectors and collector systems, 14:30756 (R;DE;In German)

Spectrally Selective Surfaces
Inexpensive selective absorber produced in Denmark, 14:30757 (R;DK;In Danish)

SOLAR COOLING SYSTEMS
Facilities for testing desiccant materials and geometries of dehumidifiers for solar-regenerated desiccant cooling systems, 14:30758 (R;US)
SOLAR CYCLE
Solar-cycle dependence of the radial gradient of cosmic-ray intensity. Progress report for period ending 1988, 14:32441 (R;US)
SOLAR DRYERS
Optimization
Optimization of the tobacco-drying process with respect to possible applications of solar radiation, 14:30754 (R;DE;In German)
Tobacco
Optimization of the tobacco-drying process with respect to possible applications of solar radiation, 14:30754 (R;DE;In German)
SOLAR ENERGY
Energy Conversion
Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)
Energy Storage
Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)
Organic Semiconductors
Electrochemical conversion of solar energy, 14:30743 (R;NO;In Norwegian)
Reviews
Focusing on the future: Solar thermal energy systems emerge as competitive technologies with major economic potential, 14:30700 (R;US)
SOLAR ENERGY CONVERSION
See also SOLAR THERMAL CONVERSION
Research on tandem solar cells. Volume 1. Final report. Volume 2. Appendices. Report for 15 May 1984-1 August 1985, 14:30707 (R;US)
SOLAR ENERGY RESEARCH INSTITUTE
Research Programs
Enzymology research, 14:30714 (RA;US)
SOLAR NEUTRINOS
Electromagnetic Form Factors
Neutrino electromagnetic form factors, 14:32611 (J;US)
Neutrino-Electron Interactions
Neutrino-electron scattering and the choice between different Mikheyev-Smirnov-Wolfenstein solutions of the solar neutrino problem, 14:32470 (J;US)
SOLAR ONE POWER PLANT
See BARSTOW SOLAR PILOT PLANT
SOLAR RADIATION
Pressure Measurement
Rotational motion of an artificial satellite perturbed by solar radiation pressure, 14:31860 (RA;BR)
Radiowave Radiation
Solar-Geophysical Data Number 438, February 1981. Part 2 (comprehensive reports). Data for August 1980 and miscellanea, 14:32461 (R;US)
Satellites
Rotational motion of an artificial satellite perturbed by solar radiation pressure, 14:31860 (RA;BR)
X Radiation
Solar-Geophysical Data Number 438, February 1981. Part 2 (comprehensive reports). Data for August 1980 and miscellanea, 14:32461 (R;US)
SOLAR RADIO BURSTS
Solar-Geophysical Data Number 438, February 1981. Part 2 (comprehensive reports). Data for August 1980 and miscellanea, 14:32461 (R;US)
SOLAR THERMAL CONVERSION
Research Programs
Proceedings of the annual solar thermal technology research and development conference, 14:30753 (R;US)
SOLAR-ASSISTED HEAT PUMPS
Meetings
Review and findings of the Second EX-IEA Workshop on Solar Assisted Heatpumps Systems with Ground Coupled Storage, 14:30947 (RA;CA;In English and French)
SOLDER FLUXES
See METALLURGICAL FLUX
SOLDERING FLUXES
See METALLURGICAL FLUX
SOLID CLUSTERS
Nucleation
Stochastic theory of diffusional planar-atomic clustering and its application to dislocation loops, 14:32810 (J;US)
SOLID ELECTROLYTES
Atom Transport
Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)
Density
Influence of electrolyte density on response of LiCl, 14:30968 (BA;US)
Design
Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)
Electric Conductivity
Influence of electrolyte density on response of LiCl, 14:30968 (BA;US)
Thermodynamic Properties
Controlled electrolyte environments and their use for studying and modifying materials properties, 14:31050 (BA;US)
SOLID SCINTILLATION DETECTORS
See also NAI DETECTORS
PLASTIC SCINTILLATION DETECTORS
Glass Scintillators
Detector system for two-dimensional, position-sensitive detection of neutrons and gamma quanta, 14:31816 (R;DE;In German)
SOLID STATE LASERS
See also NEODYMIUM LASERS
Amplifiers
Development of an efficient high-brightness Ti:Al_2O_3 laser amplifier. Final report, 15 August 1987-14 February 1988, 14:31626 (R;US)
Fracture Mechanics
Fracture mechanisms of solid state slab lasers, 14:31647 (BA;US)
SOLID WASTES
See also WOOD WASTES
Refuse Derived Fuels
Evaluation of rotary-drum air classification of shredded and unshredded municipal solid waste. Final report, 14:31149 (R;US)
Sanitary Landfills
Leachate treatment. January 1972-April 1989 (Citations from Pollution Abstracts). Report for January 1972-April 1989, 14:32000 (R;US)
Vitrification
Development of a multi-purpose incinerating melter, 14:30486 (RA;US)
Waste Management
Hanford site waste management units report: Volume 1, 14:30530 (R;US)
Hanford site waste management units report: Volume 2, 14:30531 (R;US)
Waste Product Utilization
Northeast Regional Biomass Energy Program: Progress report, January 1989–March 1989, 14:30672 (R;US)
SOLIDS
Acoustic Measurements
Acoustic studies of solids, 14:32785 (R;US)
Molecular Structure
Local structure evaluation in solid organophosphorus compound by double cross polarization carbon-13 nuclear magnetic resonance spectroscopy, 14:31521 (J;US)
Shock Waves
Issues in shock-induced solid state chemistry, 14:31475 (R;US)
Ultrasonic Testing
A paraxial theory for the propagation of ultrasonic beams in anisotropic solids, 14:31667 (J;US)
Viscosity
Viscosity of solids determined by shock wave action on hemispherical indentations, 14:31897 (R;US)

SOLITONS
Wave Propagation
Lossless propagation of optical pulses through *N*-level systems with Gell-Mann symmetry, 14:32847 (J;US)
SOLUTES
Polarization
Continuum electrostatics and hydration phenomena, 14:32186 (BA;US)
SOLUTIONS
See also LEACHATES
Nmr Spectra
Effectivity of perfusion solutions for kidney preservation assessed by means of /sup 31/P-NMR spectroscopy, 14:32271 (RA;DD;In German)
SOLVATED ELECTRONS
Chemical Reactions
Effect of pressure on the reaction of electrons with CO_2 in nonpolar solvents, 14:31572 (J;US)
Isotopic dependence of recombination kinetics in water, 14:31573 (J;US)
SOLVENT EXTRACTION
See also SUPERCRITICAL GAS EXTRACTION
Enhanced solvent extraction with water-in-oil microemulsions, 14:31414 (J;US)
Mathematical Models
Convergence characteristics of augmented Hessian models for separations, 14:31422 (J;US)
Mathematical modelling of extraction dynamics in differential-contact extractor, 14:31576 (R;SU;In Russian)
Phase Studies
An electrically driven multistage countercurrent solvent extraction device, 14:30297 (J;US)
SOLVENTS
See also ORGANIC SOLVENTS
Dewaxing
Improvement in coal liquefaction solvent quality by dewaxing, 14:30246 (R;US)
Indoor Air Pollution
Health-hazard evaluation determination report No. 75-146-254, Custom Furniture and Cabinets, Inc., Post Falls, Idaho, 14:31964 (R;US)
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Naphtha
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Polarization
Continuum electrostatics and hydration phenomena, 14:32186 (BA;US)
Propanols
Health-hazard evaluation report HETA-86-053-1933, Gray Pprinting Company, Fostoria, Ohio, 14:31957 (R;US)
Supercritical State
Theoretical models of thermodynamic properties of supercritical solutions, 14:31493 (J;US)
Thermodynamic Properties
Theoretical models of thermodynamic properties of supercritical solutions, 14:31493 (J;US)
SONDES
See PROBES
SONIC MEASUREMENTS
See ACOUSTIC MEASUREMENTS
SOOT
Fuels combustion research. Final technical report, 1 October 1985-30 September 1988, 14:31579 (R;US)
SOURCE TERMS
A source term methodology for spent fuel cask containment evaluations, 14:31606 (R;US)
C Codes
Validation of core debris/concrete interactions and source term models, 14:30921 (R;US)
Optimization
An estimate of the contribution of spent fuel products to the releasable source term in spent fuel transport casks, 14:30586 (R;US)
SOUTH AFRICA
Transportation Sector
Combi-taxi: past, present, and future, 14:31105 (R;ZA)
Energetic approach towards affordable transportation, 14:31104 (R;US)
SOUTH KOREA
See REPUBLIC OF KOREA
SOVIET UNION
See USSR
SPACE FLIGHT
Radiation Doses
Radiation dose in a Molniya-type orbit. Technical report, 14:32746 (R;US)
Radiation Hazards
Dosimetry of space radiation and radiation problems in manned space flight, 14:32760 (RA;IL)
SPACE HEATING
See also GEOTHERMAL SPACE HEATING
Energy Conservation
Low temperature heating in existing buildings, 14:31143 (R;DK;In Danish)
SPACE HVAC SYSTEMS
Control Systems
Mechanical controls evaluation, 14:31087 (R;CA;In English and French)
Evaluation
Mechanical systems evaluation, 14:31086 (R;CA;In English and French)
Technology Utilization
Market assessment for future technologies, 14:31066 (RA;US)
SPACE VEHICLES
Computerized Control Systems
Expert-system approach to large space-systems control. Technical report, September 1987-October 1988, 14:31891 (R;US)
Power Supplies
Fuel cells for extraterrestrial and terrestrial applications, 14:31053 (J;US)
SPACE WEAPONS
Physical Radiation Effects
Shield optimization program, Part I: Executive summary, 14:33028 (R;US)
Shielding
Shield optimization program: Part 5, A hydrodynamic comparison using HULL and PUFF-TFT for a one-dimensional aluminum slab, 14:33029 (R;US)
SPARK IGNITION ENGINES
Development of fast-burn combustion with elevated coolant temperatures for natural gas engines. Annual report, May 1987-April 1988, 14:31165 (R;US)
Exhaust Gases
Evaluation of a resistively heated metal-monolith catalytic converter on a gasoline-fueled vehicle. Technical report, 14:31160 (R;US)
SPECTROMETERS
See also BETA SPECTROMETERS
GAMMA SPECTROMETERS
INFRARED SPECTROMETERS
MULTIPARTICLE SPECTROMETERS
TIME-OF-FLIGHT SPECTROMETERS
X-RAY SPECTROMETERS
Prospects for B physics spectroscopy in Fermilab fixed target experiments, 14:32556 (J;US)
SPECTROPHOTOMETERS
Design
Last improvements of the DTC 1000 spectrophotometer, 14:30437 (R;FR;In French)
SPECTROSCOPY
See also ABSORPTION SPECTROSCOPY
ALPHA SPECTROSCOPY
MASS SPECTROSCOPY

MESON SPECTROSCOPY
NEUTRON SPECTROSCOPY
X-RAY SPECTROSCOPY

Optical Dispersion
Anomalous dispersion effects in diffuse reflectance infrared fourier transform spectroscopy: A study of optical geometries, 14:31882 (J;US)

Photoemission
Photoemission spectroscopy of single crystal HTSC materials: A Fermi liquid electronic structure, 14:31393 (R;US)

SPENT FUEL CASKS

Decontamination
In-service analysis of cask contamination weeping, 14:31610 (R;US)

Design
Advanced handling technology project and implications for cask design, 14:30595 (R;US)
Alternatives for implementing burnup credit in the design and operation of spent fuel transport casks, 14:31605 (R;US)
An estimate of the contribution of spent fuel products to the releasable source term in spent fuel transport casks, 14:30586 (R;US)

Evaluation
A source term methodology for spent fuel cask containment evaluations, 14:31606 (R;US)
Evaluation of potential benefits of transportable storage casks: Final report, 14:30822 (R;US)
Technical issues affecting the transport of dual purpose casks, 14:30580 (R;US)

Heat Transfer
HTAS2: A three-dimensional transient shipping cask analysis tool, 14:31597 (R;US)

Impact Tests
Force and moment reconstruction for a nuclear transportation cask using sum of weighted accelerations and deconvolution theory, 14:30602 (R;US)

Radioactive Waste Management
Management of cladding hulls and fuel hardware, 14:30477 (RA;US)

Radioactive Waste Processing
CEC research programme for treatment and conditioning of spent fuel hulls, 14:30476 (RA;US)

Testing
Dynamic fracture toughness measurements of ferritic ductile cast iron, 14:31604 (R;US)
Dynamics and static behavior of metal gussets in cask impact limiters, 14:31613 (R;US)
Standard thermal problem set, 14:31611 (R;US)

SPENT FUEL ELEMENTS

Radioactive Waste Management
Management of cladding hulls and fuel hardware, 14:30477 (RA;US)

SPENT FUEL STORAGE
Technical safety appraisal of the Hanford Tank Farm Facility, 14:30526 (R;US)

Public Opinion
Psychological aspects of nuclear waste disposal: Long time perception and the question of discounting of risks, 14:30606 (R;SE)
Time orientation, planning horizons and responsibility into the future, 14:30605 (R;SE)

SPENT FUELS

Radioactive Waste Storage
A cask maintenance facility feasibility study, 14:30525 (R;US)
Comparison of analysis methods for burnup credit applications, 14:30588 (R;US)
Technical issues affecting the transport of dual purpose casks, 14:30580 (R;US)

Reprocessing
Application of lasers to CANDU nuclear fuel reprocessing, 14:30439 (RA;US)

SPENT SHALES

Combustion
Oil shale industrialization in Brazil, 14:30367 (RA;CN)

Fluidized-Bed Combustion
Modified-in-situ technology combined with aboveground retorting and circulating fluid bed combustors could offer a viable method to unlock oil shale reserves in the near future, 14:30360 (RA;CN)

Sorptive Properties
Sorption of pyridine and quinoline onto rundle spent shale, 14:30421 (RA;CN)

Waste Product Utilization
Investigation on the Portland pozzolana cement with more shale ash content, 14:30406 (RA;CN)
Multipurpose use of shale ash and its paragenetic mineral in China, 14:30404 (RA;CN)
Properties of shale ash (taken from the boiling furnace) Portland cement, 14:30405 (RA;CN)
Studies on strength and workability of high-strength and flowing concrete utilizing low calcium oil shale ash, 14:30407 (RA;CN)

SPERM
See SPERMATOZOA

SPERMATIDS
See SPERMATOZOA

SPERMATOZOA

Cell Division
Male-driven molecular evolution: a model and nucleotide sequence analysis, 14:32164 (BA;US)

SPIN-OFF
See TECHNOLOGY TRANSFER

SPINACH

Energy-Level Transitions
Electronic excitation transport in core antennae of enriched photosystem I particles from spinach chloroplasts, 14:31531 (J;US)

SPINAL CORD

Computerized Tomography
CT in diastematomyelia and diplomyelia, 14:32302 (RA;DD;In German)
NMR imaging and CT of the spinal canal, 14:32298 (RA;DD;In German)

Malformations
CT in diastematomyelia and diplomyelia, 14:32302 (RA;DD;In German)
MRI of spinal AV-malformations, 14:32300 (RA;DD)
Pre- and postoperative MRT findings in syringohydromyelia, 14:32301 (RA;DD;In German)

Neoplasms
Differential diagnosis of intraspinal tumors by MRT, 14:32299 (RA;DD;In German)

Nmr Imaging
Differential diagnosis of intraspinal tumors by MRT, 14:32299 (RA;DD;In German)
MRI of spinal AV-malformations, 14:32300 (RA;DD)
NMR imaging and CT of the spinal canal, 14:32298 (RA;DD;In German)
Pre- and postoperative MRT findings in syringohydromyelia, 14:32301 (RA;DD;In German)
Three-dimensional representation in neuroradiology, 14:32323 (RA;DD;In German)

SPINE
See VERTEBRAE

SPLEEN

Computerized Tomography
Computed tomography of splenic trauma, 14:32255 (RA;DD)

Injuries
Computed tomography of splenic trauma, 14:32255 (RA;DD)

SPR-3 REACTOR

Reactor Safety
Technical Safety Appraisal of the Sandia reactors, ACRR [Annular Core Research Reactor], SPR III [Sandia Pulse Reactor III], Sandia National Laboratories, Albuquerque, 14:30899 (R;US)

SPRAY DRYING

Residues
Building constructions using cement containing a desulfurization product, 14:31116 (R;DK;In Danish)

SPRAY PONDS
See SPRAYS

SPRAYS
Combustion Properties
KIVA-II: A computer program for chemically reactive flows with sprays, 14:31161 (R;US)
SQUID DEVICES
Sensitivity
Hot-electron limitation to the sensitivity of the dc superconducting quantum interference device, 14:31625 (J;US)
STAINLESS STEEL-18-4-1
See STAINLESS STEELS
STAINLESS STEEL-19-9DL
See STAINLESS STEELS
STAINLESS STEEL-Z6CND17-12
See STEEL-CR17NI12MO3
STAINLESS STEELS
Austenitic Steels
Ductile crack growth in nuclear austenitic stainless steel plates: influence of crack orientation and steel microstructure, 14:31205 (R;BR)
Contamination
Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)
Corrosion
Microbial corrosion: 1988 workshop proceedings, 14:30865 (R;US)
STANDARD MODEL
Symmetry Breaking
Symmetry breaking: The standard model and superstrings, 14:32618 (R;US)
STANDING CROP
See BIOMASS
STANFORD LINEAR ACCELERATOR CENTER
Environmental Impacts
Annual environmental monitoring report, January–December 1988, 14:31702 (R;US)
STANFORD LINEAR COLLIDER
Beam Bunching
Transverse and longitudinal coupled bunch instabilities in trains of closely spaced bunches, 14:31724 (R;US)
Beam Optics
The optical design of the spin manipulation system for the SLAC Linear Collider, 14:31726 (R;US)
Beam Transport
Momentum slits, collimators and masks in the SLC, 14:31780 (R;US)
Diagnostic Techniques
Long ion chamber systems for the SLC [Stanford Linear Collider], 14:31779 (R;US)
Research Programs
The Stanford Linear Collider, fall 1988, 14:31704 (R;US)
STARFISH EVENT
Electromagnetic Pulses
Did high-altitude EMP [electromagnetic pulse] cause the Hawaiian streetlight incident?, 14:31903 (R;US)
STARS
See also MAGNETIC STARS
Detection
Mass distribution in the galactic centre estimated from OH/IR stars, 14:32460 (R;SE)
Meetings
Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium, 14:32445 (R;FR)
Nucleosynthesis
Fast neutron contribution to nucleosynthesis reaction rates, 14:32456 (RA;SU;In Russian)
Ultraviolet Spectra
Decade of UV astronomy with the IUE satellite. Volume 1 Proceedings of a celebratory symposium, 14:32445 (R;FR)
Ultraviolet emission from the sun and stars: a comparison of IUE and skylab spectra, 14:32449 (RA;FR)
STATE BUILDINGS
See PUBLIC BUILDINGS
STATE GOVERNMENT
Allocations
State uses of Exxon and Stripper Well oil overcharge funds: Status report No. 3, 14:30306 (R;US)
STATES (ENERGY)
See ENERGY LEVELS
STATIC LOADS
Mechanical Tests
Dynamics and static behavior of metal gussets in cask impact limiters, 14:31613 (R;US)
STATISTICAL DATA
Reliability
Validity and reliability of results of epidemiological studies for the estimation of the radiation included lung cancer risk, 14:32380 (RA;AT)
STATISTICAL MODELS
Energy Levels
On statistical theory of overlapping resonances, 14:32724 (RA;SU;In Russian)
Energy-Level Density
On statistical theory of overlapping resonances, 14:32724 (RA;SU;In Russian)
STATISTICS
Computer Codes
User guide for the Data Analysis, Retrieval, and Tabulation System (DARTS): A mainframe computer code for generating cross-tabulation reports, 14:30970 (R;US)
Correlations
Error estimates on averages of correlated data, 14:33005 (R;DK)
STEAM
Explosions
Steam explosions in slurry fed ceramic melters, 14:30508 (RA;US)
STEAM COOLANT
See STEAM
STEAM GENERATORS
Tubes
PWR steam generator tube fretting and fatigue wear: Final report, 14:30839 (R;US)
STEAM SYSTEMS
Modifications
Rochester district-heating-system reconfiguration: technical and economic feasibility. Final report, 14:31151 (R;US)
STEEL INDUSTRY
See METAL INDUSTRY
STEEL-000KH25
See STAINLESS STEELS
STEEL-000KH28
See STAINLESS STEELS
STEEL-00KH20N32T
See STAINLESS STEELS
STEEL-03KH13AG13
See STAINLESS STEELS
STEEL-08G2SFB
See CARBON STEELS
STEEL-0KH18G8N2T
See STAINLESS STEELS
STEEL-12KH2MV8FB
See STEELS
STEEL-12KH2V5FB
See STEELS
STEEL-15KHG2SFMR
See CHROMIUM-MOLYBDENUM STEELS
STEEL-1KH18N9
See STEEL-CR18NI9
STEEL-20KHMF
See CHROMIUM-MOLYBDENUM STEELS
STEEL-2KH8V8M2K8
See CHROMIUM-MOLYBDENUM STEELS
STEEL-38KH5MSFA
See CHROMIUM-MOLYBDENUM STEELS
STEEL-7KH18N9
See STEEL-CR18NI9

STEEL-CR17NI12MO3
Fractures
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
Reactor Components
Fatigue life prediction for a cold worked T316 stainless steel, 14:31201 (R;BR)
Strain Aging
Fatigue life prediction for a cold worked T316 stainless steel, 14:31201 (R;BR)
Temperature Dependence
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
STEEL-CR18NI9
Fractures
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
Temperature Dependence
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
STEEL-CR19NI10
Degassing
Hydrogen induced surface effects on the mechanical properties of type 304 stainless steel, 14:31202 (R;BR)
Fractures
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
Hydrogen Embrittlement
Hydrogen induced surface effects on the mechanical properties of type 304 stainless steel, 14:31202 (R;BR)
Hydrogenation
Hydrogen induced surface effects on the mechanical properties of type 304 stainless steel, 14:31202 (R;BR)
Mechanical Properties
Hydrogen induced surface effects on the mechanical properties of type 304 stainless steel, 14:31202 (R;BR)
Temperature Dependence
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
STEEL-CR25NI20
Fractures
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
Temperature Dependence
Temperature dependence of the fracture in austenitic stainless steels, 14:31203 (R;BR)
STEEL-DIN-1-4301
See STEEL-CR18NI9
STEEL-DIN-1-4919
See STEEL-CR17NI12MO3
STEEL-KH18N9
See STEEL-CR18NI9
STEEL-Z10CDV7
See CHROMIUM-MOLYBDENUM STEELS
STEELS
See also AUSTENITIC STEELS
CARBON STEELS
HIGH ALLOY STEELS
Micro-alloying of steels. February 1977-April 1989 (Citations from the COMPENDEX data base). Report for February 1977-April 1989, 14:31223 (R;US)
Corrosion
Gamma irradiation and in-situ corrosion studies on unalloyed steels for a high level waste packaging in a rock salt repository, 14:30566 (R;DE)
The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel, 14:31236 (BA;US)
Cutting
Effects of auxiliary heat treatments on flame-cutting procedures, 14:31190 (R;US)
Defects
Evaluation of elastic-plastic surface flaw behavior and related parameters using surface displacement measurements, 14:31195 (R;US)
Hydrogen Embrittlement
The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel, 14:31236 (BA;US)
Radiation Monitoring
25 years of reference measurements in the Karlsruhe whole-body counter: /sup 137/Cs in man, /sup 60/Co in steel, /sup 226/Ra and /sup 232/Th in paper, 14:32012 (RA;AT;In German)
Specifications
Explanations on nomenclature and number of material for steels in accordance with DIN norm - (Deutsch Industrie Norm), 14:31197 (R;BR;In Portuguese)
Standardized Terminology
Explanations on nomenclature and number of material for steels in accordance with DIN norm - (Deutsch Industrie Norm), 14:31197 (R;BR;In Portuguese)
Surface Coating
The effect of amorphous nickel-phosphorous alloy layers on the absorption of hydrogen into steel, 14:31236 (BA;US)
STELLARATORS
See also TORSATRON STELLARATOR
Magnet Coils
Design of a large helical system for magnetic fusion experiments, 14:32934 (J;US)
STEMMING MATERIALS
Performance Testing
Prevention of oil shale dust explosions, 14:30417 (RA;CN)
STES
See SEASONAL THERMAL ENERGY STORAGE
STOCHASTIC PROCESSES
Rotational States
Intermediate statistics of quasienergy spectrum and quantum localization of classical chaos, 14:32826 (R;SU;In Russian)
STOMACH
Measuring Methods
Method to directly measure maximum volume of fish stomachs or digestive tracts, 14:30696 (RA;US)
STOPPING
See ABSORPTION
STORAGE (SPENT FUEL)
See SPENT FUEL STORAGE
STORAGE BATTERIES
See ELECTRIC BATTERIES
STORAGE BATTERIES (LEAD-ACID)
See LEAD-ACID BATTERIES
STORAGE FACILITIES
Radioactive Wastes
Location-independent study concerning the construction, operation and closure of possible facilities for the final storage of radioactive waste in rock-salt formations in the Netherlands. Executed by Van Hattum and Blankevoort asked for by the Netherlands Energy Research Foundation and subsidized by the Ministry of Economic Affairs, 14:30564 (R;NL;In Dutch)
Safety
Technical safety appraisal of the Hanford Tank Farm Facility, 14:30526 (R;US)
Specifications
Location-independent study concerning the construction, operation and closure of possible facilities for the final storage of radioactive waste in rock-salt formations in the Netherlands. Executed by Van Hattum and Blankevoort asked for by the Netherlands Energy Research Foundation and subsidized by the Ministry of Economic Affairs, 14:30564 (R;NL;In Dutch)
STORAGE RINGS
See also BROOKHAVEN RHIC
LEP STORAGE RINGS
SERPUKHOV TEVATRON
SUPERCONDUCTING SUPER COLLIDER
Beam Bunching
Bunch lengthening calculations for the SLC [Stanford Linear Collider] damping rings, 14:31791 (R;US)
Beam Emittance
A formalism and computer program for coupled lattices, 14:31793 (R;US)
Analytic estimates of coupling in damping rings, 14:31794 (R;US)

Beam Injection
Filamentation of phase space and coherent noise for beams injected into storage rings, 14:31740 (R;DE)
Design
HISTRAP [Heavy Ion Storage Ring for Atomic Physics] prototype hardware studies, 14:31786 (R;US)
Electron Cooling
Theory of ion deceleration in magnetized temperature-anisotropic electron plasma, 14:31718 (R;SU;In Russian)
Modulation
Investigation into modulators. Progress report, 14:31790 (R;NL;In Dutch)
Performance
The proton storage ring: Problems and solutions, 14:31788 (R;US)
Reviews
Status of the SIS/ESR-project at GSI, 14:31695 (R;DE)
Wiggler Magnets
Installation of a ferrite undulator in the MAX storage ring, 14:31789 (R;SE)

STORES
See COMMERCIAL BUILDINGS

STRANGE MESONS
See also K*-892 MESONS
KAONS
Spectroscopy
The spectroscopy of mesons containing strange quarks, 14:32551 (J;US)

STRANGEONIUM
See also PHI-1680 MESONS
Physical Properties
The strangeonium spectrum seen in Lass; implications for glueball spectroscopy, 14:32558 (J;US)

STRATEGIC DEFENSE INITIATIVE
See BALLISTIC MISSILE DEFENSE

STRATEGIC PETROLEUM RESERVE
Extraction
Oil velocities in the Weeks Island mine during oil recycle exercises, 14:30285 (R;US)
Inspection
Technical safety appraisal of the strategic petroleum reserve, West Hackberry/Big Hill/New Orleans, 14:30299 (R;US)

STRAW
Organic Acids
Use of hemicellulose hydrolate in the production of fatty acids, 14:32175 (R;DK;In Danish)

STREAMER SPARK CHAMBERS
Underground
Tracking techniques in underground physics, 14:31813 (R;IT)

STREETS
See ROADS

STRENGTH (FRACTURE)
See FRACTURE PROPERTIES

STRESSES
Detection
The PVDF [polarized polyvinylidene fluoride polymer film] piezoelectric polymer shock-stress sensor: Signal conditioning and analysis for field test application, 14:31865 (R;US)

STRING MODELS
P Invariance
Parity-violating one-loop function in lower-dimensional type-I string theory, 14:32625 (J;US)
Symmetry Breaking
Symmetry breaking: The standard model and superstrings, 14:32618 (R;US)
Symmetry in string theory, 14:32624 (J;US)

STRONTIUM 88 TARGET
Coupled Channel Theory
Neutron-hole strengths and core-coupling in /sup 87/Sr via the /sup 88/Sr(/sup 3/He, α)/sup 87/Sr reaction, 14:32664 (R;FR)
Holes
Neutron-hole strengths and core-coupling in /sup 87/Sr via the /sup 88/Sr(/sup 3/He, α)/sup 87/Sr reaction, 14:32664 (R;FR)

STRONTIUM 90
Ion Exchange
Improved ion exchange method for treatment of slightly contaminated wastewaters, 14:30459 (RA;US)

STRONTIUM CHLORIDES
Diffusion
Ternary mutual diffusion coefficients of NaCl-$SrCl_2$-H_2O at 25°C. 2. Total concentrations of 2.0 and 3.0 mol×dm^{-3}, 14:31532 (J;US)

STRONTIUM COMPOUNDS
See also STRONTIUM CHLORIDES
STRONTIUM OXIDES
Superconductivity
Composition of superconducting $La_2CuO_{4+\delta}$: A superconductor doped by excess oxygen defects, 14:31270 (R;US)

STRONTIUM OXIDES
Microstructure
Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)
Specific Heat
Low-temperature specific heat of single-crystal $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$, 14:31313 (J;US)
Specific heat of $Bi_2Sr_2CuO_6$ and $Bi_2Sr_2CaCu_2O_8$ in the superconducting state, 14:31309 (J;US)
Superconductivity
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
Transport critical current density in $Bi_2Sr_2CaCu_2O_x$ single crystals, 14:31300 (J;US)

STRUCTURAL BUCKLING
See DEFORMATION

STRUCTURAL MODELS
Response Functions
Structural engineering, mechanics and materials: Final report, 14:31618 (R;US)

STRUCTURE (CRYSTAL)
See CRYSTAL STRUCTURE

STRUCTURE (MOLECULAR)
See MOLECULAR STRUCTURE

STRUCTURE-ACTIVITY RELATIONSHIPS
Characterization of three-dimensional structures, 14:31478 (BA;US)
Mathematical Models
Rational selection of graph-theoretical indices in the QSAR, 14:32194 (BA;US)

STRUCTURES (BUILDINGS)
See BUILDINGS

STRUCTURES (MECHANICS)
See MECHANICAL STRUCTURES

STYRENE POLYMERS
See POLYSTYRENE

STYRENE-DIVINYLBENZENE COPOLYMER
See POLYSTYRENE-DVB

SUBBITUMINOUS COAL
Coal Liquefaction
Batch autoclave testing of subbituminous coals of Alberta. Carbon monoxide/steam and dispersed catalyst process, 14:30242 (R;CA)
Batch autoclave tests for the liquefaction of Alberta subbituminous coals: I.G. Farben liquefaction process, 14:30241 (R;CA)
Conversion
Batch autoclave tests for the liquefaction of Alberta subbituminous coals: I.G. Farben liquefaction process, 14:30241 (R;CA)
Liquefaction
Liquefaction characteristics of Highvale coal in the Dow Coal Liquefaction Process, 14:30243 (R;CA)
Pyrolysis
Review of the literature on experimental studies of the pyrolysis and hydropyrolysis of coal, 14:30244 (R;CA)

SUBCONTRACTORS
See CONTRACTORS

SUBMARINES
Decommissioning
Low-Level Waste Ocean Disposal Program final report: Site characterization of the Pacific Study Area, West Coast, Northern Site (W-N), 14:30577 (R;US)
SUBMERGED ARC WELDING
Welding Fluxes
Electrochemical reactions in submerged arc welding with SiO_2-CaO-CaF_2 fluxes with high and low silica contents, 14:31274 (R;US)
SUBSTRATES
Biochemical Reaction Kinetics
Atomic protein structures reveal basic features of binding of sugars and ionic substrates, and calcium cation, 14:32123 (BA;US)
Performance
Silver-coated fumed silica as a substrate material for surface-enhanced raman scattering, 14:31409 (J;US)
Roughness
The effects of substrate roughness on ultrathin water films, 14:31549 (J;US)
Specificity
Evolution of specificity and catalysis in subtilisin, 14:32144 (BA;US)
Wettability
The effects of substrate roughness on ultrathin water films, 14:31549 (J;US)
SUBSURFACE ENVIRONMENTS
Geophysical Surveys
High resolution subsurface imaging with geophysical diffraction tomography, 14:32419 (R;US)
SUBURBS
See URBAN AREAS
SUCCINIC ACID
Neutron Diffraction
Determination of the absolute configuration of (-)-(2R)-succinic-2-d acid by neutron diffraction study: Unambiguous proof of the absolute stereochemistry of the NAD^+/NADH interconversion, 14:32355 (J;US)
SULFHYDRYL COMPOUNDS
See THIOLS
SULFIDES
See also COPPER SULFIDES
HYDROGEN SULFIDES
IRON SULFIDES
LITHIUM SULFIDES
MOLYBDENUM SULFIDES
THORIUM SULFIDES
TITANIUM SULFIDES
URANIUM SULFIDES
Desulfurization
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
Solvent Properties
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
SULFITES
Chemical Reactions
Fluorometric measurement of aqueous ammonium ion in a flow injection system, 14:31405 (J;US)
SULFONES
Efficiency
Separation of nitrogen isotopes by displacement band chromatography, 14:31491 (J;US)
SULFONIC ACIDS
Solvent Properties
Selective extraction of Cu^{2+} and Ag^+ ions from sulfuric acid by synergistic combinations of tetradentate thia macrocycles with didodecylnaphthalene sulfonic acid, 14:31417 (J;US)
Synergistic solvent extraction of manganese by macrocyclic crown ethers in combination with didodecylnaphthalene sulfonic acid: effect of macrocycle substituents, 14:31416 (J;US)
SULFUR
Chemical Analysis
A simple purge system for determination of sulfur using the direct-current plasma, 14:31402 (J;US)
Removal
Preliminary study on hydrotreating of a high sulfur content shale oil, 14:30361 (RA;CN)
SULFUR 32 REACTIONS
Spallation
Baryon production in the central region of ultrarelativistic heavy-ion collisions, 14:32745 (J;US)
SULFUR 32 TARGET
Sulfur 32 Reactions
Baryon production in the central region of ultrarelativistic heavy-ion collisions, 14:32745 (J;US)
SULFUR COMPOUNDS
See also SULFIDES
SULFITES
SULFUR OXIDES
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
Removal
Concentration and removal of nitrogen and sulfur containing compounds from organic liquids phases using electrochemically reversed chemical complexation, 14:30268 (J;US)
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
SULFUR DIOXIDE
Absorption
Theoretical approach for enhanced mass transfer effects in-duct flue gas desulfurization processes: Quarterly report No. 3, January 1, 1989–March 31, 1989, 14:30274 (R;US)
Ecological Concentration
Dutch priority programme on acidification: Summary report, Acidification research, 1984–1988, 14:31969 (R;NL)
Mathematical Models
Advanced Utility Simulation Model, program documentation. State-level model (Version 1.0). Final report, September 1980-August 1985, 14:30799 (R;US)
Advanced Utility Simulation Model: report of sensitivity testing, calibration, and model-output comparisons (Version 3.0). Final report, December 1987-May 1988, 14:30800 (R;US)
Measuring Methods
N_2O field study. Final report, 14:30810 (R;US)
Pollution Control
Combined SO_2/NO_x control technologies, 14:30271 (R;US)
Removal
Environmental Research Program: FY 1988 annual report, 14:31931 (R;US)
Environmental research program: FY 1987, annual report, 14:31929 (R;US)
Scrubbing
Utilization potential of circulating fluidized bed combustion residue in construction applications. Final report, 14:30272 (R;CA)
Separation Processes
Gas separation properties of phosphazene polymer membranes, 14:31433 (J;US)
SULFUR HYDRIDES
See HYDROGEN SULFIDES
SULFUR OXIDES
See also SULFUR DIOXIDE
Removal
1.0 Million Btu combustor testing: Test results: Part 2, 14:30803 (R;US)
SULFUR SULFIDES
See SULFUR
SULFURIC ACID
Indoor Air Pollution
Health-hazard evaluation determination report No. 77-31-432, Inland Steel Corporation, East Chicago, Indiana, 14:31947 (R;US)
Materials Recovery
Acid recovery of polyamine, 14:30661 (RA;US)

Concentrated acid hydrolysis with acid recovery, 14:30662 (RA;US)

SUN
Ultraviolet Spectra
Ultraviolet emission from the sun and stars: a comparison of IUE and skylab spectra, 14:32449 (RA;FR)

SUPER HIGH FREQUENCY RADIATION
See RADIOWAVE RADIATION

SUPER PHENIX REACTOR
Fuel Assemblies
Manufacture of the first fuel charge for the SUPER-PHENIX 1 reactor, 14:30847 (R;FR)

SUPERALLOYS
See HEAT RESISTING ALLOYS

SUPERCOMPUTERS
Ibm Computers
2-D fluid dynamics models for laser driven fusion on IBM 3090 vector multiprocessors, 14:32907 (R;IT)
Parallel Processing
2-D fluid dynamics models for laser driven fusion on IBM 3090 vector multiprocessors, 14:32907 (R;IT)
Supercomputers for solving PDE problems. Final report, 1 October 1985-31 March 1988, 14:32980 (R;US)
Vector Processing
2-D fluid dynamics models for laser driven fusion on IBM 3090 vector multiprocessors, 14:32907 (R;IT)
Supercomputers for solving PDE problems. Final report, 1 October 1985-31 March 1988, 14:32980 (R;US)

SUPERCONDUCTING CABLES
Design
Development of superconducting strand and cable with improved properties for use in SSC [Superconducting Super Collider] magnets, 14:31763 (R;US)
Straight ends for superconducting dipole magnet using "constant perimeter" geometry, 14:31764 (R;US)
Technology Assessment
Assessment of higher-temperature superconductors for utility applications: Final report, 14:30811 (R;US)

SUPERCONDUCTING CAVITY RESONATORS
Control Systems
An improved phase-control system for superconducting low-velocity accelerating structures, 14:31692 (R;US)
Tuning
New fast tuning system for the Atlas Accelerator, 14:31732 (R;US)

SUPERCONDUCTING FILMS
Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988, 14:31266 (R;US)
Plasma Arc Spraying
Interaction of plasma-sprayed YBa/sub y/Cu/sub 3/0/sub x/ coatings with alumina substrates, 14:31284 (R;CA)

SUPERCONDUCTING JUNCTIONS
See also JOSEPHSON JUNCTIONS
Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988, 14:31266 (R;US)

SUPERCONDUCTING MAGNETS
Program CICC, flow and heat transfer in cable-in-conduit conductors: Equations and verification, 14:31617 (R;US)
Superconducting magnetic energy storage (SMES). January 1972-April 1989 (Citations from the NTIS database). Report for January 1972-April 1989, 14:31602 (R;US)
Control
Passive superconductor: A viable method of controlling magnetization multipoles in the SSC dipole, 14:31766 (R;US)
Cryogenics
Cryogenic techniques for large superconducting magnets in space, 14:31599 (R;US)
Design
A large superconducting detector magnet without an iron return path, 14:31825 (R;US)
Training of LBL-SSC model dipole magnets at 1.8 K, 14:31765 (R;US)
Production
[Visit to Bruker Analytische Messtechnik to expedite delivery of the AGS Booster Quadrupole Magnet Coils, Karlsruhe, W. Germany, February 16- March 4, 1989]: Foreign trip report, 14:31735 (R;US)

SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES
See SQUID DEVICES

SUPERCONDUCTING SUPER COLLIDER
Data Acquisition Systems
Triggering and data acquisition aspects of SSC tracking, 14:31855 (R;US)
Trigger Circuits
Triggering and data acquisition aspects of SSC tracking, 14:31855 (R;US)

SUPERCONDUCTORS
See also TYPE-II SUPERCONDUCTORS
Crystal-Phase Transformations
Structural phase transformations and superconductivity in $La_{2-x}Ba_xCuO_4$, 14:31303 (J;US)
Deformation
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Electrical Properties
High-frequency cavity applications and measurements of high-temperature superconductors, 14:31333 (R;US)
Electronic Structure
Assessment of Fermi-liquid description for the normal state of high-T_c superconductors, 14:32818 (J;US)
Magnetic Fields
Field structure of vortex lattices in uniaxial superconductors, 14:32817 (J;US)
Plasticity
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Spectroscopy
Photoemission spectroscopy of single crystal HTSC materials: A Fermi liquid electronic structure, 14:31393 (R;US)
Stoichiometry
Composition of superconducting $La_2CuO_{4+\delta}$: A superconductor doped by excess oxygen defects, 14:31270 (R;US)
Superconductivity
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)

SUPERCRITICAL GAS EXTRACTION
Chemical Reaction Kinetics
Supercritical extraction of Chinese oil shales, 14:30338 (RA;CN)

SUPERFLUID MODEL
Energy-Level Density
Evaporation neutron spectra and nuclear level density, 14:32727 (RA;SU;In Russian)

SUPERFUND
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)
Amendments
Toxic chemical release inventory magnetic media submission instructions. Section 313 of the emergency planning and community right-to-know act (revision), 14:30980 (R;US)
Information Systems
Toxic chemical release inventory magnetic media submission instructions. Section 313 of the emergency planning and community right-to-know act (revision), 14:30980 (R;US)

SUPERGIANT STARS
Infrared Spectra
Galactic and LMC extreme emission line supergiants compared: IUE observations of the Henize - Carlson and Zoo star samples of massive supergiants, 14:32453 (RA;FR)
Ultraviolet Spectra
Galactic and LMC extreme emission line supergiants compared: IUE observations of the Henize - Carlson and Zoo star samples of massive supergiants, 14:32453 (RA;FR)

SUPERLATTICES
Annealing
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
Crystal Growth
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
Hamiltonians
Density of states of ordered and disordered superlattices, 14:32792 (RA;BR)
Optical Properties
Effects of thermal annealing on In/sub x/Ga/sub 1-x/As/Ga As strained-layer superlattices, 14:31207 (RA;BR)
Order-Disorder Transformations
Density of states of ordered and disordered superlattices, 14:32792 (RA;BR)
SUPERNOVA REMNANTS
See also CRAB NEBULA
Cosmic Radiation
Equations of cosmic-ray transport with distributed acceleration, 14:32443 (R;US)
SUPERSYMMETRY
Ward Identity
Schwinger-Dyson equations as supersymmetric Ward identities, 14:32619 (R;DK)
SUPERTANKERS
See TANKER SHIPS
SUPERVOLTAGE RADIOTHERAPY
See RADIOTHERAPY
SUPPORTED LIQUID MEMBRANES
Efficiency
Comparison of bulk, emulsion, thin sheet supported, and hollow fiber supported liquid membranes in macrocycle-mediated cation separations, 14:31428 (J;US)
Separation Processes
Supported liquid membrane separation of aluminum from copper leaching liquors, 14:31431 (J;US)
SURFACE PROPERTIES
Bibliographies
International bulletin on atomic and molecular data for fusion. No. 38, 14:32873 (R;XA)
SURFACE WATERS
See also LAKES
PONDS
Radionuclide Migration
A model for global cycling of tritium, 14:32959 (J;US)
Water Pollution
A model for global cycling of tritium, 14:32959 (J;US)
SURFACE-ACTIVE AGENTS
See SURFACTANTS
SURFACES
Acoustic Measurements
Proposed technique for surface dynamics measurements at high pressure, 14:31492 (J;US)
Heat Flux
Heat-transfer predictions and experiments in a motored engine, 14:31155 (R;US)
Neutron Diffraction
Theory of the critical X-ray and neutron scattering at surfaces, 14:32798 (R;DE;In German)
Wave Propagation
Radiation from waves guided by nonuniform active surfaces, 14:32841 (R;US)
X-Ray Diffraction
Theory of the critical X-ray and neutron scattering at surfaces, 14:32798 (R;DE;In German)
SURFACTANTS
Adsorption
Surfactant loss: Effects of temperature, salinity, and wettability, 14:30292 (R;US)
SURPLUS NUCLEAR FACILITIES
Remedial Action
Expediting cleanup at the Weldon Spring site under CERCLA and NEPA, 14:32026 (R;US)
Site Surveys
Results of the independent verification of radiological remedial action at 480 South Main Street, Monticello, Utah (MS00049), 14:32022 (R;US)
SURVEILLANCE (RADIOACTIVITY)
See RADIATION MONITORING
SURVEY (RADIOACTIVITY)
See RADIATION MONITORING
SUSPENSIONS
See also SLURRIES
Water Removal
Electro-acoustic dewatering (EAD) a novel approach for food processing, and recovery, 14:31455 (J;US)
SWEAT GLANDS
See SKIN
SWEDEN
Carbon Dioxide
Emission of carbon dioxide from anthropogenic sources in Sweden, 14:31926 (R;SE;In Swedish)
Earthquakes
Source parameters of major earthquakes near Kiruna, Northern Sweden, deduced from synthetic seismogram computation, 14:32421 (R;SE)
Occupational Exposure
Nuclear power industry: Activity emissions, occupational exposures, 14:32780 (R;SE;In Swedish)
Radioactive Effluents
Nuclear power industry: Activity emissions, occupational exposures, 14:32780 (R;SE;In Swedish)
Radioecology
Biological and radioecological investigations at Ringhals nuclear power plant 1968-1987, 14:30887 (R;SE;In Swedish)
Research Programs
Swedish shale gasification research program, 14:30366 (RA;CN)
Seasonal Thermal Energy Storage
Aquifer heat storage technology in Sweden, 14:30932 (RA;CA;In English and in French)
Brunkeberg aquifer thermal storage in central Stockholm, 14:30935 (RA;CA;In English and French)
Low temperature thermal aquifer storage. A full scale experiment with the purpose of avoiding long term cooling of the subsurface environment, 14:30934 (RA;CA;In English and French)
Sensible Heat Storage
Thermal energy storage programme in Sweden, 14:30987 (RA;CA;In English and French)
Supply and Demand
Electric power market report 1988, 14:31034 (R;SE;In Swedish)
SWEDISH ORGANIZATIONS
Regulations
Disposal of radioactive waste in land burial facilities at Studsvik. Inspection notes, 14:30641 (R;SE;In Swedish)
SWIMMING POOL TANK REACTOR AUSTRIA
See ASTRA REACTOR
SWITCHES
See also PLASMA SWITCHES
SEMICONDUCTOR SWITCHES
Photoconductivity
Saturation behavior of silicon Auston switches, 14:31884 (J;US)
SWITCHING CIRCUITS
Design
Magnetic switching, 14:31783 (R;US)
SYMPATHECTOMY
See AUTONOMIC NERVOUS SYSTEM
SYMPATHETIC NERVOUS SYSTEM
See AUTONOMIC NERVOUS SYSTEM
SYNCHROPHASOTRONS
See SYNCHROTRONS
SYNCHROTRON RADIATION
Beam Optics
[International conference on synchrotron radiation application, with visits to Beijing, Hefei, and Shanghai, China, April 30–May 18, 1989]: Foreign trip report, 14:31712 (R;US)
Detection
Precision synchrotron radiation detectors, 14:31777 (R;US)

SYNCHROTRONS
See also BROOKHAVEN AGS
FERMILAB TEVATRON
SERPUKHOV SYNCHROTRON
SERPUKHOV TEVATRON
Electron Cooling
Theory of ion deceleration in magnetized temperature-anisotropic electron plasma, 14:31718 (R;SU;In Russian)
Reviews
Status of the SIS/ESR-project at GSI, 14:31695 (R;DE)
SYNCRUDE
See SYNTHETIC PETROLEUM
SYNOVIA
See BONE JOINTS
SYNTHETASES
See LIGASES
SYNTHETIC CRUDE OIL
See SYNTHETIC PETROLEUM
SYNTHETIC FUELS REFINERIES
Oil Shale Processing Plants
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report, third quarter, 1988. Report for 1 July-30 September 1988, 14:30424 (R;US)
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. Second quarter 1988. Report for 1 April-30 June 1988, 14:30423 (R;US)
UNOCAL Parachute Creek Shale Oil Program. Environmental monitoring plan quarterly report. First quarter 1988. Report for 1 January-31 March 1988, 14:30422 (R;US)
UNOCAL Parachute Creek Shale Oil Project. Monitoring review committee meeting report. Annual meeting, 1987-1988, 14:30425 (R;US)
SYNTHETIC PETROLEUM
Coprocessing
Upgrading of shale oil by an ebullated-bed reactor, 14:30364 (RA;CN)
Production
Unocal Corporation's commercial experience in upgrading shale oil to produce a high quality syncrude, 14:30362 (RA;CN)
Upgrading Julia Creek shale oil - syncrude or fully refined products, 14:30363 (RA;CN)
Refining
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
SYNTHETIC-APERTURE RADAR
Performance Testing
The effects of snow on landmarks in K_u band SAR [Synthetic Aperture Radar] images, 14:31866 (R;US)
SYNTHINE PROCESS
See FISCHER-TROPSCH SYNTHESIS

T

TANDEM MIRRORS
Plasma Confinement
Definition of adiabaticity of nonparaxial magnetic mirror, 14:32875 (R;SU;In Russian)
TANK FARMS
See STORAGE FACILITIES
TANKER SHIPS
Accidents
Report of investigation surrounding the cirumstances in which the Canadian oil tanker "L'Orme No.1" heavily struck the Ultramar wharf and the ensuing fire, in Quebec harbour on February 1,1988, 14:30309 (R;CA;In English and Frech)
TANTALUM
Deformation
Deformation and failure mechanisms of niobium and tantalum during tensile testing in uranium at 1473 K, 14:31240 (J;US)
Electron Collisions
Measurement of electron energy deposition necessary to form an anode plasma in Ta, Ti, and C for coaxial bremsstrahlung diodes, 14:32888 (J;US)
Ion Beam Targets
Spectroscopy of ionic alkali halide excimers excited by laser-produced plasmas, 14:31641 (BA;US)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
TANTALUM 182
Internal Conversion
Position-sensitive detector for local plane of the beta-spectrometer, 14:31822 (R;SU;In Russian)
Spectra Unfolding
Position-sensitive detector for local plane of the beta-spectrometer, 14:31822 (R;SU;In Russian)
TANTALUM COMPOUNDS
Chemical Preparation
Synthesis and properties of novel cluster phases: Progress report ending June 30, 1989, 14:31471 (R;US)
TAR SAND OIL
See BITUMENS
TAR SANDS
See OIL SANDS
TASK SCHEDULING
Recommendations
Proceedings of the DOE workshop on the role of a high-current accelerator in the future of nuclear medicine, 14:32348 (R;US)
TATB
Additives
High explosives reaction model and its application to booster performance, 14:31894 (R;US)
Compression
Single-pulse Raman scattering study of triaminotrinitrobenzene under shock compression, 14:31527 (J;US)
Detonations
Shock initiation modeling of multicomponent explosives, 14:31893 (R;US)
TAU LEPTONS
See TAU PARTICLES
TAU PARTICLES
Leptonic Decay
Mass ratio m/sub c//m/sub b/ in semi-leptonic b-decays, 14:32593 (J;NL)
TAUONS
See TAU PARTICLES
TAXICABS
Government Policies
Combi-taxi: past, present, and future, 14:31105 (R;ZA)
TBP
Phase Studies
Effect of uranium on third phase formation in the Pu(IV)-HNO_3-TBP-dodecane system, 14:30445 (J;US)
Solvent Properties
Recovery of plutonium and americium from chloride salt wastes by solvent extraction, 14:30431 (J;US)
Restoring solvent for nuclear separation processes, 14:30444 (J;US)
Thermodynamic modeling of chemical equilibria in metal extraction, 14:31420 (J;US)
TECHNETIUM
Leaching
Model investigations for trace analysis of iodine, uranium, and technetium in saturated sodium chloride leaching solutions of stored radioactive waste, 14:30565 (R;DE;In German)
Voltametry
Stripping voltammetry of technetium(VII) by means of a glassy carbon electrode chemically modified with a TPAC loaded copolymer film, 14:31392 (R;DE;In German)
TECHNETIUM 99
Adsorption
Research on the adsorption of technetium and iodine in some minerals, 14:32006 (R;CN;In Chinese)
TECHNOLOGY TRANSFER
Planning
Brookhaven National Laboratory technology transfer five year plan fiscal years 1990-1994, 14:30985 (R;US)

TECTONICS
Evaluation
State of stress and the relation to tectonics in the central Savannah River area of South Carolina, 14:32429 (R;US)
TELESCOPES
See also RADIO TELESCOPES
Cosmic Ray Sources
Coded mask telescope for observations of X and gamma ray sources in the Southern sky, 14:31797 (RA;BR)
Images
Coded mask telescope for observations of X and gamma ray sources in the Southern sky, 14:31797 (RA;BR)
TELLURIUM 130 TARGET
Krypton 86 Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Proton Reactions
Isobaric yield curves at A=72 from the spallation of medium mass isotopes by intermediate energy protons, 14:32671 (J;US)
TEM (MICROSCOPY)
See TRANSMISSION ELECTRON MICROSCOPY
TEMPERATURE (ELECTRON)
See ELECTRON TEMPERATURE
TEMPERATURE DEPENDENCE
Mathematical Models
3D thermal stress analysis of WIPP room T RH TRU experiments, 14:30584 (R;US)
TEMPERATURE DISTRIBUTION
On the self-consistency of the principle of profile consistency results for sawtoothing tokamak discharges, 14:32881 (R;US)
TENDONS (STRUCTURAL)
See CABLES
TERPENES
Biosynthesis
The effects of atmospheric CO_2 on insect herbivores and their hosts plants: Progress report, 14:31924 (R;US)
TERRESTRIAL ECOSYSTEMS
Acidification
Environmental aspects. Development of a computer model for environmental impact of energy production, 14:32002 (R;DK;In Danish)
Evaluation
Fate and effects of PAHs in the terrestrial environment: An overview, 14:31995 (R;US)
TERTIARY RECOVERY
See ENHANCED RECOVERY
TESTING (MATERIALS)
See MATERIALS TESTING
TETRAHYDRONAPHTHALENE
See TETRALIN
TETRAHYDROPYRROLES
See PYRROLIDINES
TETRAHYMENA
Molecular Biology
Implications of intermolecularly catalyzed reactions by the Tetrahymena ribozyme, 14:32094 (BA;US)
Structures involved in Tetrahymena rRNA self-splicing and RNA enzyme activity, 14:32093 (BA;US)
TETRALIN
Thermodynamic Properties
High-temperature heat-capacity measurements and critical property determinations using a Differential Scanning Calorimeter: Results of measurements on toluene, tetralin, and JP-10, 14:30313 (R;US)
TEVATRON
See FERMILAB TEVATRON
TEXAS
Geology
Bureau of Economic Geology annual report, 1988, 14:30278 (R;US)
TFTR DEVICE
See TFTR TOKAMAK
TFTR REACTORS
See TFTR TOKAMAK
TFTR TOKAMAK
Beam Injection Heating
TFTR [Tokamak Fusion Test Reactor] neutral beam injected power measurement, 14:32928 (R;US)
Cleaning
System design for disposal of tritium at TFTR, 14:32946 (J;US)
Control Systems
Technical aspects of the upgrade and commissioning of the tritium and related systems at TFTR, 14:32944 (J;US)
Exhaust Gases
A tritium compatible plasma exhaust system for a large tokamak, 14:32942 (J;US)
Magnetic Shielding
Tritium detectors employed at the Tokamak Fusion Test Reactor, 14:32950 (J;US)
Operation
TFTR health physics tritium measurements following D-D operations, 14:32953 (J;US)
TFTR tritium program, 14:32945 (J;US)
Performance
A tritium-compatible piezoelectric valve for the Tokamak Fusion Test Reactor, 14:32949 (J;US)
Physics
TFTR health physics tritium measurements following D-D operations, 14:32953 (J;US)
Radioactive Waste Processing
Transportation of tritiated waste from fusion facilities, 14:32940 (J;US)
Safety
Operating experience and procedures at the tritium systems test assembly, 14:32943 (J;US)
Transport Theory
The gBL transport equations, 14:32883 (R;US)
THALLIUM OXIDES
Electric Conductivity
Fluctuation conductivity of Tl-Ba-Ca-Cu-O thin films, 14:31310 (J;US)
Specific Heat
Low-temperature specific heat of single-crystal $Bi_2CaSr_2Cu_2O_8$ and $Tl_2Ca_2Ba_2Cu_3O_{10}$, 14:31313 (J;US)
Superconductivity
Coupling strengths and flux pinning in oxide superconductors, 14:31301 (J;US)
THERAPEUTIC AGENTS
See DRUGS
THERAPY
See also RADIOTHERAPY
Planning
Importance of the complex radiological diagnosis for the decision on therapeutical treatment of malformations of cerebral blood vessels, 14:32333 (RA;DD;In German)
THERMAL ANALYSIS
Benchmarks
Standard thermal problem set, 14:31611 (R;US)
THERMAL CONDUCTIVITY
Evaluation
The use of a thermal probe to determine the effective thermal conductivity of packaging contents, 14:30587 (R;US)
THERMAL DECOMPOSITION
See PYROLYSIS
THERMAL DIFFUSION
D Codes
Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)
Mathematical Models
A critique of trennschaukel operation, 14:31864 (R;US)
S Codes
Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)
T Codes
Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)

THERMAL EFFLUENTS
Biological Effects
Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)
Experimental Data
Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)
Removal
Tritium emissions reduction facility, 14:32935 (J;US)
Thermal Pollution
Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)
THERMAL ENERGY STORAGE EQUIPMENT
Pilot Plants
Prototype of underground high-temperature heat storage in Thiverval-Grignon (France), 14:30933 (RA;CA;In French)
Scale Control
Short-term aquifer thermal energy storage (ATES) test cycles, 14:30946 (RA;CA;In English and French)
THERMAL INSULATION
Coatings
Thermal-insulating coatings. January 1970-April 1989 (Citations from the COMPENDEX data base). Report for January 1970-April 1989, 14:31286 (R;US)
Plastics
Dynamic characteristics of PUR cellular plastic in pre-insulated district heating pipes, 14:31146 (R;DK;In Danish)
THERMAL NEUTRONS
Compiled Data
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)
Inelastic Scattering
Effect of thermal neutron acceleration by vibrationally-excited nitrogen molecules, 14:32749 (RA;SU;In Russian)
L Codes
Use of ETOG and ETOT computer codes for preparating the Library of LEOPARD with data from ENDFIB-IV, 14:32993 (R;BR;In Portuguese)
Nitrogen
Effect of thermal neutron acceleration by vibrationally-excited nitrogen molecules, 14:32749 (RA;SU;In Russian)
THERMAL POLLUTION (AIR)
See AIR POLLUTION
THERMAL POLLUTION (WATER)
See WATER POLLUTION
THERMAL POWER PLANTS
See also COMBINED-CYCLE POWER PLANTS
FOSSIL-FUEL POWER PLANTS
NUCLEAR POWER PLANTS
Biological Effects
Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)
Thermal Effluents
Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)
Thermal Pollution
Recipient control at Forsmark power station 1987, 14:32074 (R;SE;In Swedish)
THERMAL SPRINGS
Age Estimation
Formation condition of the Lushan hot spring and its genesis, 14:32068 (RA;XA)
Isotope Ratio
Application of oxygen and hydrogen isotopes of waters in Tengchong hydrothermal systems of China, 14:32056 (RA;XA)
Formation condition of the Lushan hot spring and its genesis, 14:32068 (RA;XA)
Review of data of oxygen and hydrogen isotope composition in thermal waters in China, 14:32064 (RA;XA)
THERMAL STORAGE
See HEAT STORAGE
THERMIONIC DIODES
Capacitance
The Pierce diode with an external circuit. I. Oscillations about nonuniform equilibria, 14:32534 (J;US)
The Pierce diode with an external circuit. II. Chaotic behavior, 14:32535 (J;US)
THERMOCOUPLES
Design
Design and testing of a heated thermocouple liquid level probe, 14:30875 (R;US)
Temperature Measurement
Proceedings of the industrial temperature measurement symposium, 14:31880 (B;US)
THERMOLUMINESCENT DOSEMETERS
Calcium Fluorides
Fading of CaF/sub 2/-Tm (TLD-300), 14:31840 (RA;AT)
Calibration
Calibration of thermoluminescence dosemeters for personnel dosimetry, 14:31836 (RA;AT;In German)
Response Functions
Relative sensitivity of thermoluminescent materials to 15MeV neutrons. New experimental data with respect to the shape of the glow curve and influence of the encapsulating material, 14:31841 (RA;AT)
THERMOLUMINESCENT DOSIMETRY
Calibration
Long-term sensitivity with an automatic TL personnel dosimetry system, 14:31837 (RA;AT;In German)
THERMONUCLEAR DEVICES
See also OPEN PLASMA DEVICES
Confinement
Radiation versus transport losses in fusion devices, 14:32916 (RA;BR)
Steady-State Conditions
Radiation versus transport losses in fusion devices, 14:32916 (RA;BR)
Toroidal Configuration
Radiation versus transport losses in fusion devices, 14:32916 (RA;BR)
THERMONUCLEAR POWER PLANTS
Environmental Impacts
Safety and environmental aspect of fusion, 14:32917 (RA;BR)
Safety
Safety and environmental aspect of fusion, 14:32917 (RA;BR)
THERMONUCLEAR REACTOR MATERIALS
Breeding Blankets
EXOTIC: Development of ceramic tritium breeding materials. Annual progress report 1987, 14:32904 (R;NL)
THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS
THERMOPILES
See THERMOCOUPLES
THETA-1640 RESONANCES
See F2-1720 MESONS
THIN FILMS
Determination of the mechanical properties of diamond and diamond-like films by the ultra-low load indentation technique, 14:31317 (R;US)
Structure Factors
The effects of substrate roughness on ultrathin water films, 14:31549 (J;US)
Vacuum Coating
Deposition techniques for the preparation of thin film nuclear targets, 14:31178 (R;AU)
X-Ray Spectra
Surface-extended x-ray-absorption fine-structure experiments at atmospheric pressure by means of a photocathode proportional counter with monolayer sensitivity, 14:31890 (J;US)
THIN-LAYER CHROMATOGRAPHY
Photoacoustic Spectroscopy
Laser-based photoacoustic densitometer for two-dimensional scanning of thin-layer chromatographic plates, 14:31881 (J;US)
THIO COMPOUNDS
See ORGANIC SULFUR COMPOUNDS

THIOALCOHOLS
See THIOLS
THIOETHERS
See SULFIDES
THIOLS
Chemical Reactions
Reactions of ethanethiol on Mo(110): formation and decomposition of a surface alkyl thiolate, 14:31514 (J;US)
Desulfurization
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
THIOPHENE
Biodegradation
Microbial removal of organic sulfur from coal: Final report, October 1985–September 1988, 14:30262 (R;US)
Desulfurization
Comparison of thermodynamics of nitrogen and sulfur removal in heavy oil upgrading: Part 1, Acyclic and monocyclic compounds, 14:30310 (R;US)
THIRRING MODEL
Bogolyubov Transformation
Variational calculations and Bogolubov transformations, 14:32638 (J;US)
THORAX
See CHEST
THORIUM
Fluorescence
Atomic fluorescence yields W/sub M4/, W/sub M5/, W/sub N4/ and W/sub N5/ of the elements Ir,Pt,Au,Th and U, 14:32497 (RA;BR)
Radioecological Concentration
Correlation between thorium concentrations in soil and gamma readings in FUSRAP site in New Jersey, 14:32024 (J;US)
THORIUM 230
Detection
Field method for determining thorium-230 in soils, 14:30627 (R;US)
THORIUM ALLOYS
Magnetic Properties
Muon spin rotation in the magnetic and superconducting ground states of $(U,Th)Be_{13}$ and $(U,Th)Pt_3$, 14:31252 (J;US)
Superconductivity
Muon spin rotation in the magnetic and superconducting ground states of $(U,Th)Be_{13}$ and $(U,Th)Pt_3$, 14:31252 (J;US)
THORIUM ARSENIDES
Crystal Structure
Bulk moduli and high-pressure phases of ThX compounds. Pt. 1. The thorium monopnictides (ThN; ThP; ThAs; ThSb.), 14:31328 (R;DK)
THORIUM D
See LEAD 208
THORIUM FLUORIDES
Binding Energy
4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
THORIUM ISOTOPES
See also THORIUM 230
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
THORIUM NITRIDES
Crystal Structure
Bulk moduli and high-pressure phases of ThX compounds. Pt. 1. The thorium monopnictides (ThN; ThP; ThAs; ThSb.), 14:31328 (R;DK)
THORIUM OXIDES
Binding Energy
4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
THORIUM PHOSPHIDES
Crystal Structure
Bulk moduli and high-pressure phases of ThX compounds. Pt. 1. The thorium monopnictides (ThN; ThP; ThAs; ThSb.), 14:31328 (R;DK)
THORIUM SELENIDES
Bulk moduli and high pressure phases of ThX compounds. Pt. 2. The thorium monochalcogenides (ThS; ThSe; ThTe.), 14:31329 (R;DK)
THORIUM SULFIDES
Bulk moduli and high pressure phases of ThX compounds. Pt. 2. The thorium monochalcogenides (ThS; ThSe; ThTe.), 14:31329 (R;DK)
THORIUM TELLURIDES
Bulk moduli and high pressure phases of ThX compounds. Pt. 2. The thorium monochalcogenides (ThS; ThSe; ThTe.), 14:31329 (R;DK)
THROAT
See PHARYNX
THYLAKOID MEMBRANE PROTEINS
Evaluation
The role of transit peptides in the localization of chloroplastic proteins: Progress report, 14:32172 (R;US)
THYROID
Scintiscanning
Comparison of various methods relating to radionuclide examination of the thyroid gland, 14:32345 (R;DE;In German)
TIGHT SANDS
See PERMEABILITY
SANDSTONES
TIME-OF-FLIGHT SPECTROMETERS
Performance
Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)
TIMING CIRCUITS
Synchronization
Timing and rf synchronization for filling PEP/SPEAR with the SLC Damping Rings, 14:31792 (R;US)
TIN
Total Cross Sections
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
X Radiation
Total cross-section and effective atomic number of various materials for 52.4 KeV X-rays-A rapid method, 14:32493 (RA;BR)
TIN 121
Moessbauer Effect
Experimental and kinetic modeling of acid/base and redox reaction over oxide catalysts: Annual report, 14:31276 (R;US)
TIN 124 REACTIONS
Deep Inelastic Heavy Ion Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Heavy Ion Fusion Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Multi-Nucleon Transfer Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Transfer Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
TIN CHLORIDES
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)
TIN COMPOUNDS
Layers
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)

P-N Junctions
Fabrication of detectors of PbSnTe/PbTe heterostructures on BaF/sub 2/ substrates, 14:31668 (RA;BR;In Portuguese)

Photolysis
Ultraviolet absorption of the vinyl radical and reaction with oxygen, 14:31567 (J;US)

TISSUES
See also ANIMAL TISSUES
PLANT TISSUES

Computerized Tomography
Tissue discrimination - advances in CT and MRI, 14:32249 (RA;DD)

Nmr Imaging
Tissue discrimination - advances in CT and MRI, 14:32249 (RA;DD)

TITANIUM

Alloy Nuclear Fuels
Uranium alloys for using in fast breeder reactors, 14:31189 (R;BR;In Portuguese)

Electron Collisions
Measurement of electron energy deposition necessary to form an anode plasma in Ta, Ti, and C for coaxial bremsstrahlung diodes, 14:32888 (J;US)

Materials Recovery
Model for the recovery of titanium from mixtures of ilmenite and hematite by hydrochloric acid leaching, 14:31451 (J;US)

Uranium
Uranium alloys for using in fast breeder reactors, 14:31189 (R;BR;In Portuguese)

TITANIUM ALLOYS

Formation Heat
Energetics of transition-metal alloy formation: Ti, Zr, and Hf alloyed with the heavier 4*d* and 5*d* elements, 14:31250 (J;US)

Plasticity
Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking, 14:31216 (R;US)

TITANIUM BORIDES

Etching
Laser-initiated chemical vapor etching of ceramics, 14:31289 (BA;US)

Oxidation
Raman spectroscopic observation of laser-induced oxidation of transition-metal borides, carbides, and nitrides, 14:31294 (J;US)

TITANIUM CARBIDES

Etching
Laser-initiated chemical vapor etching of ceramics, 14:31289 (BA;US)

Oxidation
Raman spectroscopic observation of laser-induced oxidation of transition-metal borides, carbides, and nitrides, 14:31294 (J;US)

TITANIUM NITRIDES
Raman spectroscopic observation of laser-induced oxidation of transition-metal borides, carbides, and nitrides, 14:31294 (J;US)

TITANIUM OXIDES
See also ILMENITE

Catalytic Effects
Experimental and kinetic modeling of acid/base and redox reaction over oxide catalysts: Annual report, 14:31276 (R;US)

Chemical Properties
Physico-chemical properties of supported and unsupported γ-Al_2O_3 and TiO_2 ceramic membranes, 14:31432 (J;US)

Grain Boundaries
Study of nanophase TiO_2 grain boundaries by Raman spectroscopy, 14:31271 (R;US)

Photochemistry
Photoelectrochemistry and photochemistry of sensitized semiconductor surfaces, 14:31293 (BA;US)

Solid State Lasers
Development of an efficient high-brightness Ti:Al_2O_3 laser amplifier. Final report, 15 August 1987-14 February 1988, 14:31626 (R;US)

TITANIUM SULFIDES

Crystal Structure
Structural and NMR study of the lithiated defect thiospinels $Li_xCu_{0.07}[Ti_2]S_4$ ($0 < x < 2$), 14:31481 (J;US)

TLD (DOSEMETERS)
See THERMOLUMINESCENT DOSEMETERS

TLD (DOSIMETRY)
See THERMOLUMINESCENT DOSIMETRY

TLD SYSTEMS
See THERMOLUMINESCENT DOSEMETERS

TMPN
See HYDROXY COMPOUNDS
ORGANIC OXYGEN COMPOUNDS
PIPERIDINES

TNT

Biological Effects
TNT metabolites in animal tissues: Quarterly technical progress report No. 2, January 1, 1989–March 31, 1989, 14:32398 (R;US)

TOKAMAK DEVICES
See also DOUBLET-3 DEVICE
FT TOKAMAK
PBX DEVICES
TORE SUPRA TOKAMAK

Alpha Particles
Angular distribution of alpha particle flux on the first wall of a tokamak, 14:32879 (R;SU;In Russian)

Breeding Blankets
Helium cooled ceramic breeder in tube blanket for a Tokamak reactor, 14:32910 (RA;IT)

Electron Beam Injection
Simple, high current LaB_6 cathode, 14:32937 (J;US)

Flute Instability
On theory of stability of flute modes in a tokamak with β/sub e/ $\simeq$ 1, 14:32877 (R;SU;In Russian)

Plasma Confinement
Calculation of triton confinement and burn-up in tokamaks, 14:32902 (R;SE)

Tritons
Calculation of triton confinement and burn-up in tokamaks, 14:32902 (R;SE)

TOKAMAK FUSION TEST REACTOR
See TFTR TOKAMAK

TOKAMAK TYPE REACTORS
See also DOUBLET REACTORS
NET TOKAMAK
PLT DEVICES
TFTR TOKAMAK

Ecr Heating
ECH on the MTX [Microwave Tokamak Experiment], 14:32886 (R;US)

Icr Heating
Anisotropic distribution function of minority tail ions generated by strong ion-cyclotron resonance heating, 14:32884 (R;US)

Plasma Diagnostics
Propagation of a Gaussian beam in a nonhomogeneous plasma, 14:32885 (R;US)

Sawtooth Oscillations
On the self-consistency of the principle of profile consistency results for sawtoothing tokamak discharges, 14:32881 (R;US)

TOLUENE

Solvent Properties
Heats of dissolution of tar sand bitumen in various solvents, 14:30392 (R;US)

Thermodynamic Properties
High-temperature heat-capacity measurements and critical property determinations using a Differential Scanning Calorimeter: Results of measurements on toluene, tetralin, and JP-10, 14:30313 (R;US)

TOMOGRAPHY
See also COMPUTERIZED TOMOGRAPHY
Evaluation
An evaluation of cross-borehole resistivity tomography, 14:32423 (R;US)
Fermat Principle
Fermat's principle and nonlinear traveltime tomography, 14:32852 (J;US)
TONSILS
See PHARYNX
TOP PARTICLES
Particle Identification
Search for top-quark decays to real *W* bosons at the Fermilab Tevatron collider, 14:32578 (J;US)
Particle Production
Search for top-quark decays to real *W* bosons at the Fermilab Tevatron collider, 14:32578 (J;US)
TOPOLOGICAL MAPPING
Orbits
Erratic time dependence of orbits of topologically mixing maps, 14:32820 (R;XA)
TORE SUPRA
See TORE SUPRA TOKAMAK
TORE SUPRA TOKAMAK
Divertors
Role of the pump limiter throat-ergodic divertor effect on edge plasma, 14:32861 (R;FR)
Pumped Limiters
Effect of pump limiter throat on pumping efficiency, 14:32860 (R;FR)
Role of the pump limiter throat-ergodic divertor effect on edge plasma, 14:32861 (R;FR)
TORSATRON STELLARATOR
See also ATF TORSATRON
Research Programs
Torsatron/stellarator research at the University of Wisconsin-Madison, 1983, 14:32903 (R;US)
TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS
TOUGHNESS (FRACTURE)
See FRACTURE PROPERTIES
TOWERS (EXTRACTION)
See EXTRACTION COLUMNS
TOXIC MATERIALS
See also TOXINS
Superfund
Toxic chemical release inventory magnetic media submission instructions. Section 313 of the emergency planning and community right-to-know act (revision), 14:30980 (R;US)
TOXINS
See also AFLATOXIN
Molecular Structure
Solution structure of apamin determined by nuclear magnetic resonance and distance geometry, 14:32357 (J;US)
TRACER TECHNIQUES
Bench-Scale Experiments
Laboratory studies into the use of the scandium-46-EDTA complex as a tracer for groundwater flow, 14:32066 (RA;XA)
TRACKS
See PARTICLE TRACKS
TRAFFIC CONTROL
Functional Models
Transportation planning and automated guideways. Transportation research record, 14:31103 (R;US)
TRANSCRIPTION
Biochemical Reaction Kinetics
Coronavirus: a jumping RNA transcription, 14:32112 (BA;US)
Evidence implicating a tRNA heritage for the promoters of positive-strand RNA synthesis in brome mosaic and related viruses, 14:32109 (BA;US)
Evolution of the RNA coliphages: the role of secondary structures during RNA replication, 14:32108 (BA;US)
Switch from transcription to replication of a negative-strand RNA virus, 14:32113 (BA;US)
Transcription and replication of influenza virion RNA in the nucleus of infected cells, 14:32111 (BA;US)
Translational requirement for La Crosse virus S-mRNA synthesis, 14:32114 (BA;US)
Biochemistry
Group II intron self-splicing: development of alternative reaction conditions and identification of a predicted intermediate, 14:32098 (BA;US)
Nonenzymatic template-directed synthesis of information macromolecules, 14:32083 (BA;US)
Replication and evolution of short-chained RNA species replicated by Qβ replicase, 14:32106 (BA;US)
Slippery runs, shifty stops, backward steps, and forward hops: -2, -1, +1, + 2, +5, and +6 ribosomal frameshifting, 14:32148 (BA;US)
Transcripts of newt satellite DNA self-cleave in vitro, 14:32102 (BA;US)
TRANSDUCERS
Evaluation
A method for evaluating structural transducers used in Type B package testing, 14:30592 (R;US)
TRANSFER (ELECTRON)
See ELECTRON TRANSFER
TRANSFER (HEAT)
See HEAT TRANSFER
TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
TRANSFER (IN ORGANISM)
See RADIONUCLIDE KINETICS
TRANSFER (MASS)
See MASS TRANSFER
TRANSFER RNA
Biological Evolution
Evolution of anticodons: variations in the genetic code, 14:32156 (BA;US)
Phylogeny of tRNA sequences provides evidence for ambiguity reduction in the origin of the genetic code, 14:32155 (BA;US)
Molecular Biology
Evidence implicating a tRNA heritage for the promoters of positive-strand RNA synthesis in brome mosaic and related viruses, 14:32109 (BA;US)
Molecular Structure
Conformational changes and dynamics of tRNAs: evidence from hydrolysis patterns, 14:32091 (BA;US)
TRANSFORMATIONS (ONCOGENIC)
See ONCOGENIC TRANSFORMATIONS
TRANSFORMERS
Design
An SCR-switched, high voltage, high gain linear transformer system, 14:31674 (R;US)
TRANSITION ELEMENTS
See also CHROMIUM
COBALT
COPPER
GOLD
HAFNIUM
IRON
MANGANESE
MOLYBDENUM
NICKEL
NIOBIUM
RHENIUM
SCANDIUM
SILVER
TANTALUM
TECHNETIUM
TITANIUM
TUNGSTEN
VANADIUM
ZIRCONIUM
Ecr Heating
The production of beams from solid materials at the LBL ECR source, 14:31758 (R;US)

TRANSITION METALS
See TRANSITION ELEMENTS
TRANSMISSION (HEAT)
See HEAT TRANSFER
TRANSMISSION ELECTRON MICROSCOPY
Performance
High resolution transmission electron microscopy (TEM) in the study of oil shales, 14:30378 (RA;CN)
TRANSMISSION LINES
See POWER TRANSMISSION LINES
TRANSMISSION TOWERS
See POWER TRANSMISSION TOWERS
TRANSPORT
See also AIR TRANSPORT
Accidents
Transport accident frequency data, their sources and their application in risk assessment, 14:30452 (R;GB)
Containers
Enclosure of radioactive materials. Regulations, standards and practical experience, 14:30638 (RA;AT;In German)
Evaluation
Design basis for resistance to shock and vibration, 14:30599 (R;US)
TRANSPORT (CHARGED-PARTICLE)
See CHARGED-PARTICLE TRANSPORT
TRANSPORT (GAMMA)
See PHOTON TRANSPORT
TRANSPORT (IN ORGANISMS)
See RADIONUCLIDE KINETICS
TRANSPORT (NEUTRON)
See NEUTRON TRANSPORT
TRANSPORT (PHOTON)
See PHOTON TRANSPORT
TRANSPORT (RADIATION)
See RADIATION TRANSPORT
TRANSPORTATION SECTOR
Energy Conservation
Energetic approach towards affordable transportation, 14:31104 (R;US)
Regulations
Combi-taxi: past, present, and future, 14:31105 (R;ZA)
TRANSPORTATION SYSTEMS
See also BUSES
MASS TRANSIT SYSTEMS
Environmental Impacts
Issues in environmental analysis. Transportation Research Record, 14:31102 (R;US)
Planning
Transportation planning and automated guideways. Transportation research record, 14:31103 (R;US)
TRANSURANIUM COMPOUNDS
Health Hazards
United States transuranium registry: Annual report, 1 October 1987–30 September 1988, 14:32372 (R;US)
TRANSURANIUM ELEMENTS
See also PLUTONIUM
Spontaneous Fission
Spontaneous fission of the heaviest elements, 14:32739 (R;US)
TRANSURANIUM WASTES
See ALPHA-BEARING WASTES
TRAPPING
Computerized Simulation
Random-walk simulation of diffusion-controlled processes among static traps, 14:32857 (J;US)
TREATMENT (THERAPY)
See THERAPY
1,3,5-TRIAMINO-2,4,6-TRINITROBENZENE
See TATB
TRIBUTYL PHOSPHATE
See TBP
TRICHODERMA
Genetic Engineering
Targeted modifications to the structure of Trichoderma reesei CBHII, 14:30727 (RA;US)
Growth
Enzyme production on cellulose/xylose mixture, 14:30723 (RA;US)
Improvements of enzymatic hydrolysis of cellulose: strain development of Trichoderma reesei, 14:30726 (RA;US)
Immobilized Cells
Enhancement of cellulase production of Trichoderma reesei in fluidized bed reactor, 14:30724 (RA;US)
TRIGA-2-VIENNA REACTOR
Radiation Protection
Quarter century operational radiation protection at the Atominstitute, 14:30891 (RA;AT)
TRIGA-BRAZIL REACTOR
Modifications
25/sup th/ birthday of the first criticality of IPR-R1 nuclear research reactor, 14:30890 (R;BR;In Portuguese)
Uses
25/sup th/ birthday of the first criticality of IPR-R1 nuclear research reactor, 14:30890 (R;BR;In Portuguese)
TRINITROTOLUENE
See TNT
TRIPHENYLENE
Reduction
Metal-ammonia reduction of triphenylene, 14:31496 (J;US)
TRIPLET PARTICLES
See QUARKS
TRITIATED WATER
See TRITIUM OXIDES
TRITICUM
See WHEAT
TRITIUM
Air Pollution Monitoring
Dispersion of HT and HTO following an unplanned release of tritium to the atmosphere, 14:32957 (J;US)
Beta Particles
Solid-state nuclear detectors for monitoring low levels of tritium, 14:32956 (J;US)
Containment
Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)
Tritium proof-of-principle injector experiment, 14:32948 (J;US)
Emission
Tritium emissions reduction facility, 14:32935 (J;US)
Environmental Transport
Operational experience with the DATS sampler during the Canadian tritium modeling experiment, 14:32961 (J;US)
Tritium penetration through concrete, 14:30618 (J;US)
U.S. team measurements during the June 1987 experimental HT release at the Chalk River Nuclear Laboratories, Ontario, Canada, 14:32960 (J;US)
Exhaust Recirculation Systems
Tritium emissions reduction facility, 14:32935 (J;US)
Fuel Pellets
Tritium proof-of-principle injector experiment, 14:32948 (J;US)
Ground Release
Tritium distribution modeling in a Light Water New Production Reactor, 14:30894 (R;US)
Inventories
Measurement and prediction of tritium holdup, 14:32955 (J;US)
Materials Handling
A new tritium facility - The Weapons Engineering Tritium Facility at Los Alamos National Laboratory, 14:32938 (J;US)
Tips for the fabrication of temporary tritium experiments, 14:32947 (J;US)
Monitoring
Solid-state nuclear detectors for monitoring low levels of tritium, 14:32956 (J;US)
Tritium detectors employed at the Tokamak Fusion Test Reactor, 14:32950 (J;US)
Muon-Catalyzed Fusion
Three-body molecular formation in muon-catalyzed *d-t* fusion: The role of configuration mixing, 14:32519 (J;US)

Plumes
Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)
Pumps
A new glove-box system for a high-pressure tritium pump, 14:31624 (J;US)
Radioactive Clouds
Overview of the assessment of the french in-field tritium experiment with computer codes, 14:31981 (R;FR)
Radioactive Waste Management
The safety record at the tritium systems test assembly, 14:32936 (J;US)
Rain Water
Tritium activity in Australian rainwater 1962-1986, 14:32050 (R;AU)
Recovery
Physical inventory by use of modeling for the tritium aqueous waste recovery system, 14:32952 (J;US)
Recycling
A model for global cycling of tritium, 14:32959 (J;US)
Removal
Improvements in efficiency, capacity, and reliability of Mound's effluent removal system, 14:32951 (J;US)
Storage
TFTR tritium program, 14:32945 (J;US)
Water Pollution
Comments on the gas-phase initial rate of tritiated water formation, 14:32962 (J;US)

TRITIUM EXTRACTION PLANT
Environmental Impacts
A new tritium facility - The Weapons Engineering Tritium Facility at Los Alamos National Laboratory, 14:32938 (J;US)

TRITIUM OXIDES
Environmental Exposure Pathway
Dispersion of HT and HTO following an unplanned release of tritium to the atmosphere, 14:32957 (J;US)
Health Hazards
TFTR health physics tritium measurements following D-D operations, 14:32953 (J;US)
Molecular Sieve Process
System design for disposal of tritium at TFTR, 14:32946 (J;US)

TRITIUM PRODUCTION REACTORS
M Codes
Preliminary risks associated with postulated tritium release from production reactor operation, 14:32958 (J;US)

TRITIUM SYSTEMS TEST ASSEMBLY
Demonstration Programs
Tips for the fabrication of temporary tritium experiments, 14:32947 (J;US)
Experiment Planning
Tritium proof-of-principle injector experiment, 14:32948 (J;US)
Operation
Operating experience and procedures at the tritium systems test assembly, 14:32943 (J;US)
Performance
Operation of the TSTA isotope separation system with 100 gram tritium, 14:32963 (J;US)
Radioactive Waste Processing
Estimating the tritiated hydrocarbon decontamination factor by heavy methane, 14:32939 (J;US)
Reliability
The data collection system for failure/maintenance at the tritium systems test assembly, 14:32941 (J;US)
Safety
The safety record at the tritium systems test assembly, 14:32936 (J;US)

TRITIUM TARGET
Alpha Reactions
Study on the /sup 3/H + α and /sup 3/He + α elastic scatterings in a state with zero orbital moment, 14:32734 (R;SU)
Neutron Reactions
Investigation of intermediate neutron interaction with tritium and hydrogen, 14:32653 (RA;SU;In Russian)
Triton Reactions
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)

TRITON REACTIONS
One-Nucleon Transfer Reactions
Electromagnetic decay of 10/sup +/ states and yrast isomers in /sup 208/Pb, 14:32682 (J;NL)

TRITONS
Diffusion
Diffusion of tritons, deuterons, and protons in $LiNbO_3$ crystals, 14:31366 (J;US)
Particle Losses
Calculation of triton confinement and burn-up in tokamaks, 14:32902 (R;SE)
Particle Production
TFTR health physics tritium measurements following D-D operations, 14:32953 (J;US)
Thermonuclear Reactions
Calculation of triton confinement and burn-up in tokamaks, 14:32902 (R;SE)

TROJAN REACTOR
Corrosion
Examination of pits in Trojan nuclear power plant steam generator tubes: Final report, 14:30840 (R;US)

TROPOSPHERE
Radionuclide Migration
A model for global cycling of tritium, 14:32959 (J;US)

TRU WASTES
See ALPHA-BEARING WASTES

TRUCKS
Management
Demonstration and evaluation of an integrated truck management system in a producing Canadian surface coal or oil sands mine, 14:30336 (R;CA)
Monitoring
Demonstration and evaluation of an integrated truck management system in a producing Canadian surface coal or oil sands mine, 14:30336 (R;CA)

TRYPSIN
Electrophoresis
Indirect fluorometric detection in gel electrophysics, 14:31404 (J;US)

TSTA
See TRITIUM SYSTEMS TEST ASSEMBLY

TUBES
Wear
PWR steam generator tube fretting and fatigue wear: Final report, 14:30839 (R;US)

TUBES (CONDUITS)
See PIPES

TUFF
Rock Mechanics
Experiments in rock mechanics for the site characterization of Yucca Mountain, 14:30583 (R;US)
Results of pressurized-slot measurements in the G-Tunnel underground facility, 14:30589 (R;US)
Saturation
Relevance of partial saturation to the mechanical behavior of tuffs, 14:30581 (R;US)

TUMORS
See NEOPLASMS

TUNGSTEN
Chemical Vapor Deposition
A mechanism for selectivity loss during tungsten CVD, 14:31350 (J;US)
Mechanical Properties
Comparison of experimental shock-wave profiles for tungsten and computer simulations using a rate-dependent constitutive model, 14:32802 (R;US)
Physical Radiation Effects
Simulated response of multilayer x-ray reflectors to damaging fluxes, 14:31238 (J;US)

TUNGSTEN ALLOYS
Plasticity
Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking, 14:31216 (R;US)
TUNGSTEN CARBIDES
Oxidation
Raman spectroscopic observation of laser-induced oxidation of transition-metal borides, carbides, and nitrides, 14:31294 (J;US)
TUNGSTOPHOSPHATES
Electrical Properties
Electronic instabilities of the quasi-two-dimensional monophosphate tungsten bronze $P_4W_{12}O_{44}$, 14:31378 (J;US)
TUNNEL EFFECT
Crystal Structure
Theoretical study of resonant tunneling in a double barrier structures, 14:32788 (RA;BR)
Numerical Solution
Tunneling through a time-modulated barrier - relation to tunneling times, 14:32833 (R;DK)
TURBINE BLADES
Failures
Steam turbine off-frequency operation, 14:30802 (R;CA)
Fracture Mechanics
Flap-by-flap testing for materials fatigue in Aerostar 7.5 m wind-turbine blades, 14:30788 (R;DK;In Danish)
Repair
Development of a prototype robotic system for the in-situ repair of hydraulic turbine runners, 14:31671 (R;CA)
TURBOGENERATORS
Frequency Response Testing
Electrical parameters of large turbo-generators, 14:30796 (R;CA)
TURKEY
Oil Shale Deposits
Current situation with respect to oil shale research and the use of oil shale in the Federal Republic of Germany, 14:30325 (RA;CN)
Radioactive Waste Disposal
Prediction of radiation effects from proposed low-level waste disposal sites in Turkey, 14:32023 (J;US)
TURNOVER (RADIONUCLIDES)
See RADIONUCLIDE KINETICS
TWO-PHASE FLOW
Internal Waves
Small internal waves in two-fluid systems. Technical summary report, 14:31651 (R;US)
TYPE-II SUPERCONDUCTORS
Electronic Structure
Electronic structure and chemical bond of high Tc superconductors, 14:31268 (R;FR;In French)
TYPE-III SUPERCONDUCTORS
See TYPE-II SUPERCONDUCTORS

U

UCLBL
See LAWRENCE BERKELEY LABORATORY
UCLLL
See LAWRENCE LIVERMORE LABORATORY
UHF RADIATION (01-100 GHZ)
See RADIOWAVE RADIATION
UHF RADIATION (100-1000 MHZ)
See RADIOWAVE RADIATION
UHF RADIATION (LOWER RANGE)
See RADIOWAVE RADIATION
UHF RADIATION (UPPER RANGE)
See RADIOWAVE RADIATION
ULCC
See TANKER SHIPS
ULTRAHIGH FREQUENCY RADIATION (01-100 GHZ)
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (100-1000 MHZ)
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (LOWER RANGE)
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (UPPER RANGE)
See RADIOWAVE RADIATION
ULTRASONIC WAVES
Wave Propagation
A paraxial theory for the propagation of ultrasonic beams in anisotropic solids, 14:31667 (J;US)
ULTRASONICS
See ULTRASONIC WAVES
UNDERGROUND DISPOSAL
Sealing Materials
Rock sealing - interim report on the rock seealing project (stage 1), 14:30608 (R;SE)
UNDERGROUND HEAT DISTRIBUTION SYSTEMS
See HEAT DISTRIBUTION SYSTEMS
UNDERGROUND MINING
Bibliographies
Thick seam mining methods review of CMRC literature search, 14:30279 (R;CA)
Strata Control
Procedural guide for roof bolt anchorage tests, 14:31685 (R;CA)
Vehicles
Safety evaluation of a prototype hydride-powered underground-mining vehicle. Final report, May 1984-May 1987, 14:32410 (R;US)
UNDERWATER VEHICLES
See SUBMARINES
UNIFIED GAUGE MODELS
See also GRAND UNIFIED THEORY
STANDARD MODEL
Lattice Field Theory
SU(2) lattice gauge theory with an external field, 14:32635 (R;DK)
UNION OF SOVIET SOCIALIST REPUBLICS
See USSR
UNITED KINGDOM
Energy Policy
Nuclear power and the greenhouse effect. UKAEA memorandum to the House of Commons Select Committee on Energy, 14:30855 (R;GB)
Nuclear Power
Nuclear power and the greenhouse effect. UKAEA memorandum to the House of Commons Select Committee on Energy, 14:30855 (R;GB)
Oil Shale Deposits
Organic geochemistry of the onshore Kimmeridge clay oil shale of Britain, 14:30333 (RA;CN)
Radioactive Waste Facilities
Windscale Vitrification Plant and vitrified product store, 14:30498 (RA;US)
UNITED STATES OF AMERICA
See USA
UNIVERSITY MINAS GERAIS TRIGA REACTOR
See TRIGA-BRAZIL REACTOR
UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY
See LAWRENCE BERKELEY LABORATORY
UNSTEADY FLOW
Heat Flux
Design and calibration of a local heat-flux measurement system for unsteady flows, 14:31661 (J;US)
UPSILON-10350 RESONANCES
See UPSILON-10355 MESONS
UPSILON-10355 MESONS
Physical Properties
Why is the $\Upsilon(3S)$ different?, 14:32623 (J;US)
UPSILON-10500 RESONANCES
See UPSILON-10575 MESONS
UPSILON-10575 MESONS
Decay
Coupled-channel effects in the decay $\Upsilon(3S) \rightarrow \Upsilon(1S)\pi^+\pi^-$, 14:32615 (J;US)

URANIUM
See also NATURAL URANIUM
Adsorption
Uranium recovery from seawater by adsorption, 14:31446 (J;US)
Dissolution
Photochemical destruction of organic compounds formed during dissolution of uranium carbide in nitric acid, 14:30447 (J;US)
Dolomite
Advantage of uranium contained in low grade dolomite ore, 14:30427 (R;BR;In Portuguese)
Fabrication
How to minimize wastes, 14:31180 (R;FR;In French)
Fluorescence
Atomic fluorescence yields W/sub M4/, W/sub M5/, W/sub N4/ and W/sub N5/ of the elements Ir,Pt,Au,Th and U, 14:32497 (RA;BR)
Getters
Measurement and prediction of tritium holdup, 14:32955 (J;US)
Inner-Shell Ionization
M-subshell ionization of U by light ion bombardment, 14:32499 (RA;BR)
Isotope Ratio
High precision isotopic analyses of uranium and plutonium by total sample volatilization and signal integration, 14:31473 (R;US)
Leaching
Model investigations for trace analysis of iodine, uranium, and technetium in saturated sodium chloride leaching solutions of stored radioactive waste, 14:30565 (R;DE;In German)
M Shell
M-subshell ionization of U by light ion bombardment, 14:32499 (RA;BR)
Mass Transfer
Uranium and zirconium mass transfer testing of 5.5-cm-diam centrifugal contactors, 14:30446 (J;US)
Nondestructive Analysis
Nondestructive assay measurements of gaseous diffusion process equipment, 14:30625 (R;US)
Phase Studies
Effect of uranium on third phase formation in the Pu(IV)-HNO_3-TBP-dodecane system, 14:30445 (J;US)
Quantity Ratio
Advantage of uranium contained in low grade dolomite ore, 14:30427 (R;BR;In Portuguese)
Recovery
Advantage of uranium contained in low grade dolomite ore, 14:30427 (R;BR;In Portuguese)
Solvent Extraction
Solvent extraction with organophosphines - commercial & potential applications, 14:31412 (J;US)
Study of the INER process for uranium recovery from wet-process phosphoric acid, 14:30430 (J;US)
Wastes
How to minimize wastes, 14:31180 (R;FR;In French)
URANIUM 233
Alpha Spectroscopy
Trace uranium analysis by isotope dilution alpha and mass spectrometry and comparison with other techniques, 14:30428 (RA;BR)
Isotope Dilution
Trace uranium analysis by isotope dilution alpha and mass spectrometry and comparison with other techniques, 14:30428 (RA;BR)
Trace uranium analysis in geological sample by isotope dilution-alpha spectrometry and comparison with other techniques, 14:31391 (R;BR;In Portuguese)
Mass Spectroscopy
Trace uranium analysis by isotope dilution alpha and mass spectrometry and comparison with other techniques, 14:30428 (RA;BR)
Minerals
Evaluation of the mass spectrometric isotope dilution technique with the addition of two tracers (/sup 233/U and /sup 235/U) in the determination of the concentration and distribution of uranium in minerals, 14:31390 (R;BR;In Portuguese)
Neutron Spectra
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Scintillation Counting
Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent extraction-liquid scintillation count method, 14:31805 (R;CN;In Chinese)
Solvent Extraction
Study on determination of trace α-nuclide contents in aqueous solution with TRPO solvent extraction-liquid scintillation count method, 14:31805 (R;CN;In Chinese)
URANIUM 234
Heavy Ion Emission Decay
Heavy-fragment radioactivity of ^{234}U, 14:32693 (J;US)
URANIUM 235
Alpha Spectroscopy
Trace uranium analysis by isotope dilution alpha and mass spectrometry and comparison with other techniques, 14:30428 (RA;BR)
Isotope Dilution
Trace uranium analysis by isotope dilution alpha and mass spectrometry and comparison with other techniques, 14:30428 (RA;BR)
Mass Spectroscopy
Trace uranium analysis by isotope dilution alpha and mass spectrometry and comparison with other techniques, 14:30428 (RA;BR)
Minerals
Evaluation of the mass spectrometric isotope dilution technique with the addition of two tracers (/sup 233/U and /sup 235/U) in the determination of the concentration and distribution of uranium in minerals, 14:31390 (R;BR;In Portuguese)
Neutron Spectra
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
URANIUM 235 TARGET
Fast Fission
Angular anisotropy of fragments of /sup 235/U fission induced by 0.014-7.15 MeV neutrons, 14:32684 (RA;XA)
Fission
Evaluation of the energy dependence of the average number of prompt neutrons 4u-bar p for neutron-induced fission of /sup 235/U in the 0-20 MeV energy range, 14:32685 (RA;XA)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
Fission Fragments
Angular anisotropy of fragments of /sup 235/U fission induced by 0.014-7.15 MeV neutrons, 14:32684 (RA;XA)
URANIUM 236 TARGET
Neutron Reactions
Evaluated nuclear constants for uranium-236 (Preprint No. 2), 14:32690 (R;XA)
Measurement of the neutron radiative capture cross-sections for /sup 236/U and /sup 197/Au in the 3-420 keV energy range, 14:32687 (RA;XA)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
URANIUM 238 TARGET
Experimental determination of resonance self-shielding factors affecting the neutron radiative capture cross-section for /sup 238/U in the 10 to 140 keV energy range, 14:32686 (RA;XA)
Total neutron cross sections and average resonance parameters of uranium 238, 14:32691 (RA;SU;In Russian)
Translation of selected papers published in Nuclear Constants 2, 1985, 14:32683 (R;XA)
URANIUM ALLOYS
See also URANIUM BASE ALLOYS
Fermi Level
Fermi-level tuning in $Y_{1-x}U_xPd_3$, 14:31265 (J;US)
Plasticity
Comparison between the rate and temperature dependent plasticity models of Bammann and of Kocks and Mecking, 14:31216 (R;US)

URANIUM ARSENIDES
Crystal Structure
Bulk moduli and high pressure phases of the uranium rocksalt structure compounds. Pt. 2. The monopnictides (UN; UP; UAs; USb.), 14:31327 (R;DK)
URANIUM BASE ALLOYS
Magnetic Properties
Muon spin rotation in the magnetic and superconducting ground states of (U,Th)Be_{13} and (U,Th)Pt_3, 14:31252 (J;US)
Superconductivity
Muon spin rotation in the magnetic and superconducting ground states of (U,Th)Be_{13} and (U,Th)Pt_3, 14:31252 (J;US)
URANIUM COMPLEXES
See also URANYL COMPLEXES
Crystal Structure
Crystal structures of $(MeC_5H_4)_4U_2(\mu\text{-}NR)_2$. Unsymmetrical bridging, R = Ph, and symmetrical bridging, R = $SiMe_3$, organoimide ligands in organoactinide compounds, 14:31578 (J;US)
URANIUM CONCENTRATES
Energy Consumption
National Energy Balance - 1980, 14:31037 (R;BR;In Portuguese)
URANIUM DIOXIDE
Crystal Field
High energy magnetic inelastic neutron scattering at ISIS, 14:32752 (R;GB)
Fission Products
Study of fission gases behaviour in the Romanian UO/sub 2/, 14:30435 (R;RO;In Romanian)
Neutron Spectroscopy
High energy magnetic inelastic neutron scattering at ISIS, 14:32752 (R;GB)
URANIUM FLUORIDES
See also URANIUM HEXAFLUORIDE
Binding Energy
4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
Packaging
UF-6 cylinder overpack phenolic foam drop tests, 14:30448 (R;US)
URANIUM HEXAFLUORIDE
Dispersion Relations
A computer program for simulating the atmospheric dispersion of UF_6 and other reactive gases having positive, neutral, or negative buoyancy, 14:31907 (R;US)
URANIUM II
See URANIUM 234
URANIUM IONS
Gases
Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu, 14:32502 (RA;BR)
Solubility
Modelling uranium solubilities in aqueous solutions: Validation of a thermodynamic data base for the EQ3/6 geochemical codes, 14:31577 (R;SE)
URANIUM ISOTOPES
See also URANIUM 233
URANIUM 234
URANIUM 235
Energy-Level Density
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
Level Widths
Level density and mean radiation widths of transactinides, 14:32713 (RA;XA)
Translation of selected papers published in Nuclear Constants 3, 1985, 14:32688 (R;XA)
URANIUM MINES
Personnel
Practical experience with dose measurements in uranium mines, 14:31828 (RA;AT;In German)
Water Pollution
Application of best practicable technology to water management at Ranger Uranium mine: report of the technical working group, 14:30623 (R;AU)
URANIUM NITRATES
Criticality
Criticality experiments with a mixed oxide fuel pin array in plutonium-uranium nitrate solutions, 14:30440 (R;US)
URANIUM NITRIDES
Crystal Structure
Bulk moduli and high pressure phases of the uranium rocksalt structure compounds. Pt. 2. The monopnictides (UN; UP; UAs; USb.), 14:31327 (R;DK)
URANIUM ORES
See also URANIUM CONCENTRATES
Milling
Development of Australian radiation protection regulations in the mining and milling of radioactive ores, 14:30637 (RA;AT)
Mining Laws
Development of Australian radiation protection regulations in the mining and milling of radioactive ores, 14:30637 (RA;AT)
Radiometric Analysis
Radiogeologic reconnaissance in Perus region, Sao Paulo, Brazil, 14:31991 (R;BR;In Portuguese)
URANIUM OXIDES
See also URANIUM DIOXIDE
Binding Energy
4*f* binding-energy shifts of the light-actinide dioxides and tetrafluorides, 14:31368 (J;US)
Infrared Spectra
The Far-IR spectra of UO_2, $\alpha\text{-}U_3O_8$, and $\gamma\text{-}UO_3$ using the light pipe reflection method, 14:32510 (J;US)
URANIUM PHOSPHIDES
Crystal Structure
Bulk moduli and high pressure phases of the uranium rocksalt structure compounds. Pt. 2. The monopnictides (UN; UP; UAs; USb.), 14:31327 (R;DK)
URANIUM SELENIDES
Bulk moduli and high-pressure phases of the uranium rocksalt structure compounds. Pt. 1. The monochalcogenides, 14:31326 (R;DK)
URANIUM SULFIDES
Bulk moduli and high-pressure phases of the uranium rocksalt structure compounds. Pt. 1. The monochalcogenides, 14:31326 (R;DK)
URANIUM TELLURIDES
Bulk moduli and high-pressure phases of the uranium rocksalt structure compounds. Pt. 1. The monochalcogenides, 14:31326 (R;DK)
URANUS PLANET
Planetary Atmospheres
Micron-sized-particle impacts detected near Uranus by the Voyager 2 plasma-wave instrument. Progress report for period ending 1986, 14:32442 (R;US)
URANYL COMPLEXES
Solubility
Modelling uranium solubilities in aqueous solutions: Validation of a thermodynamic data base for the EQ3/6 geochemical codes, 14:31577 (R;SE)
Solvent Extraction
Mathematical modelling of extraction dynamics in differential-contact extractor, 14:31576 (R;SU;In Russian)
URBAN AREAS
Air Quality
Validation testing of new mechanisms with outdoor chamber data, 14:31938 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 1: comparison of CB4 and CAL mechanisms. Final report, April 1986-September 1988, 14:31939 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 2: analysis of VOC data for the CB4 and CAL photochemical mechanisms. Final report, April 1986-September 1988, 14:31940 (R;US)

Validation testing of new mechanisms with outdoor chamber data. Volume 3: calculation of photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31941 (R;US)
Validation testing of new mechanisms with outdoor chamber data. Volume 4: appendixes to photochemical-reaction photolysis rates in the UNC outdoor chamber. Final report, April 1986-September 1988, 14:31942 (R;US)

Earthquakes
Geologic considerations for urban planning in seismic environment, 14:32420 (R;XA)

Mass Transit Systems
Commuter, regional, and rail transit: research and analysis. Transportation Research Record, 14:31100 (R;US)

Transportation Systems
Issues in environmental analysis. Transportation Research Record, 14:31102 (R;US)

URINALYSIS
See URINE

URINE
Quantitative Chemical Analysis
Determination of selenium metabolites in biological fluids using instrumental and molecular neutron activation analysis, 14:31459 (J;US)
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)

US DOD
Electric Generators
Mobile electric power technologies for the Army of the future: engines, power source, and electrical aspects, 14:31005 (R;US)

US DOE
See also ANL
BNL
BATTELLE PACIFIC NORTHWEST LABORATORIES
HAPO
HANFORD ENGINEERING DEVELOPMENT LABORATORY
HANFORD RESERVATION
IDAHO CHEMICAL PROCESSING PLANT
IDAHO NATIONAL ENGINEERING LABORATORY
KANSAS CITY PLANT
LAWRENCE BERKELEY LABORATORY
LAWRENCE LIVERMORE LABORATORY
MOUND LABORATORY
NEVADA TEST SITE
ORGDP
ORNL
SANDIA LABORATORIES
SAVANNAH RIVER PLANT
SOLAR ENERGY RESEARCH INSTITUTE
STANFORD LINEAR ACCELERATOR CENTER
WIPP
WESTERN AREA POWER ADMINISTRATION

Contract Management
Systems approach to project management, 14:32965 (R;US)

Contractors
A view of the evolving DOE software copyright policy, 14:32987 (R;US)

Financial Assistance
Annual procurement and financial report, FY 1988, 14:32967 (R;US)

Procurement
Annual procurement and financial report, FY 1988, 14:32967 (R;US)

Research Programs
Demand-side load leveling battery storage at the Princeton Plasma Physics Laboratory, 14:30928 (BA;US)

US NRC
Bibliographies
Title list of documents made publicly available, March 1–31, 1989, 14:30853 (R;US)

Inspection
Evaluation of non-radiological water chemistry at power reactors, 14:30824 (R;US)

USA
See also APPALACHIA
FEDERAL REGION VIII

Nuclear Power
Remarks before the Beijing meeting of the pacific basin conference, 14:31003 (J;US)

USSR
Combined-Cycle Power Plants
Utilization of high-sulfur shale oil in power plant integrated with gasification system, 14:30402 (RA;CN)

Fossil-Fuel Power Plants
Utilization of Estonian oil shale at thermal power plants, 14:30409 (RA;CN)

Oil Shale Deposits
Conditions of kukersite deposition, 14:30331 (RA;CN)

Oil Shale Mining
Commercial zonation of the Estonia oil shale deposit, 14:30334 (RA;CN)

UTAH
Radiation Monitoring
Community Radiation Monitoring Program annual report, October 1, 1987–September 30, 1988, 14:31982 (R;US)

UTERINE CERVIX CARCINOMA
See CARCINOMAS

V

VACUUM SYSTEMS
Design
Vacuum system development status for the APS [Advanced Photon Source] storage ring, 14:31785 (R;US)

VALENCE ELECTRONS
See ELECTRONS

VALVES
Design
Design and testing of the Defense Waste Processing Facility melter drain valve, 14:30507 (RA;US)

Materials Testing
A tritium-compatible piezoelectric valve for the Tokamak Fusion Test Reactor, 14:32949 (J;US)

VANADATES
Precipitation
Obtainment of sodium vanadate in sulfuric medium, 14:31386 (R;BR;In Portuguese)

Sodium Compounds
Obtainment of sodium vanadate in sulfuric medium, 14:31386 (R;BR;In Portuguese)

Sulfuric Acid
Obtainment of sodium vanadate in sulfuric medium, 14:31386 (R;BR;In Portuguese)

VANADIUM
Catalytic Effects
Bench-scale co-processing: Quarterly report No. 2, July 1, 1988–September 30, 1988, 14:30261 (R;US)

Differential Cross Sections
Anisotropy and energy dependence of the differential neutron scattering cross-section in vanadium, 14:32753 (R;GB)

Removal
Separation of trace metal complexes for analysis of samples of high salt content by inductively coupled plasma mass spectrometry, 14:31400 (J;US)

Scattering
Anisotropy and energy dependence of the differential neutron scattering cross-section in vanadium, 14:32753 (R;GB)

VANADIUM ALLOYS
Mechanical Properties
Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988, 14:31175 (R;US)

VANADIUM COMPLEXES
Raman Spectra
Effects of solvents, axial ligation, and radical cation formation on the V=O stretching Raman frequency in vanadyl porphyrins: implications for peroxidase intermediates, 14:31498 (J;US)
VANADIUM MINERALS
See MINERALS
VANADIUM OXIDES
Catalytic Effects
Experimental and kinetic modeling of acid/base and redox reaction over oxide catalysts: Annual report, 14:31276 (R;US)
VANS
Design
Optimization of battery characteristics for urban electric van applications, 14:30964 (BA;US)
Power Supplies
Optimization of battery characteristics for urban electric van applications, 14:30964 (BA;US)
VECTOR PROCESSING
Supercomputers for solving PDE problems. Final report, 1 October 1985-31 March 1988, 14:32980 (R;US)
Iterative Methods
Comparison of several iterative techniques in the solution of symmetric banded equations on a two-pipe Cyber 205. Technical report, 1 October 1987-30 September 1988, 14:32975 (R;US)
VEHICLES
See also BUSES
ELECTRIC-POWERED VEHICLES
SPACE VEHICLES
TRUCKS
VANS
Dual-Fuel Engines
Enhancement of automotive compressed natural-gas-fuel storage via adsorbents. Final report, 14:31164 (R;US)
Hydrogen Fuels
Safety evaluation of a prototype hydride-powered underground-mining vehicle. Final report, May 1984-May 1987, 14:32410 (R;US)
Routing
A computer system for the design and experimentation of routing algorithms, 14:31096 (R;CA)
VENTILATION SYSTEMS
Evaluation
Ventilation survey manual: Revision 1, 14:31093 (R;US)
VERSENE
See EDTA
VERTEBRAE
Computerized Tomography
CT diagnosis of lumbar prolapse of an intervertebral disc, 14:32307 (RA;DD;In German)
CT studies in planning backbone operation, 14:32310 (RA;DD;In German)
Computer tomography of the backbone in the radicular lumbosacral syndrome, 14:32306 (RA;DD)
Radiation Doses
Dosimetry and radiation risk in diagnostic radiological examinations of the lumbosacral region of the spine: computerized tomography versus functional myelography, 14:32388 (RA;AT)
Skeletal Diseases
CT diagnosis of lumbar prolapse of an intervertebral disc, 14:32307 (RA;DD;In German)
Computer tomography of the backbone in the radicular lumbosacral syndrome, 14:32306 (RA;DD)
Surgery
CT studies in planning backbone operation, 14:32310 (RA;DD;In German)
VERTEBRATES
See also FISHES
MAMMALS
Blood Coagulation
Reconstructing the evolution of vertebrate blood coagulation from a consideration of the amino acid sequences of clotting proteins, 14:32165 (BA;US)
VERY HIGH FREQUENCY RADIATION
See RADIOWAVE RADIATION
VESSELS
See CONTAINERS
VESSELS (CHEMICAL REACTIONS)
See CHEMICAL REACTORS
VESSELS (PRESSURE)
See PRESSURE VESSELS
VESSELS (REACTOR)
See REACTOR VESSELS
VETERINARY MEDICINE
Research Programs
Laboratory for Energy-Related Health Research: Annual report, fiscal year 1987, 14:32394 (R;US)
VHF RADIATION
See RADIOWAVE RADIATION
VIBRATION MODES
See OSCILLATION MODES
VIBRATIONS (MECHANICAL)
See MECHANICAL VIBRATIONS
VINCA R-B REACTOR YUGOSLAVIA
See R-B REACTOR
VINYL CYANIDE
See ACRYLONITRILE
VINYL RADICALS
Chemical Reactions
Ultraviolet absorption of the vinyl radical and reaction with oxygen, 14:31567 (J;US)
Ultraviolet Spectra
Ultraviolet absorption of the vinyl radical and reaction with oxygen, 14:31567 (J;US)
VIRAL DISEASES
See also AIDS
Pathogenesis
Coronavirus: a jumping RNA transcription, 14:32112 (BA;US)
Molecular events leading to poliovirus genome replication, 14:32110 (BA;US)
Switch from transcription to replication of a negative-strand RNA virus, 14:32113 (BA;US)
Transcription and replication of influenza virion RNA in the nucleus of infected cells, 14:32111 (BA;US)
Translational requirement for La Crosse virus S-mRNA synthesis, 14:32114 (BA;US)
VISCOUS FLOW
Studies of the structure of attached and separated regions of viscous/inviscid interaction and the effects of combined surface roughness and blowing in high-Reynolds-number hypersonic flows. Final report, 1 August 1985-1 June 1988, 14:31652 (R;US)
VISITOR CENTERS
See PUBLIC BUILDINGS
VITAMINS
Mass Spectra
Use of various ionization modes for the study of molecules of biological interest, 14:31384 (R;FR;In French)
VITRIFICATION
Evaluation
Process simulation and statistical approaches for validating waste form qualification models, 14:30572 (R;US)
VLASOV EQUATION
See BOLTZMANN-VLASOV EQUATION
VLASOV INSTABILITY
See BOLTZMANN-VLASOV EQUATION
VLCC
See TANKER SHIPS
VOLATILE MATTER
Air Pollution Monitoring
Health-hazard evaluation determination report No. 73-123-298, Campbell Plastics, Inc., Schenectady, New York, 14:31962 (R;US)
Chemical Analysis
Analytical procedures for environmental quality control. Volume 1. Technical report, 14:32041 (R;US)

Sorption
Sorption of selected volatile organic constituents of jet fuels and solvents on natural sorbents from gas and solutions phases. Final report, April 1985-September 1987, 14:30298 (R;US)

VOLCANIC REGIONS
Calderas
Chemical and mineralogic trends within the Timber Mountain–Oasis Valley caldera complex, Nevada: Evidence for Multiple cycles of chemical evolution in a long-lived silicic magma system, 14:32427 (J;US)
Geologic Surveys
Volcanic centers of southwestern Nevada: Evolution of understanding, 1960–1988, 14:32425 (J;US)
Tuff
Evidence for dynamic withdrawal from a layered magma body: The Topopah Spring Tuff, southwestern Nevada, 14:32426 (J;US)

VOLTAGE DROP
Information Dissemination
Electicity supply voltage problems, 14:30817 (R;CA)

VOLTAGE REGULATORS
Computerized Simulation
PVREG - A photovoltaic voltage regulation investigation tool: Program reference manual, 14:30748 (R;US)
PVREG – a photovoltaic voltage regulation investigation tool: PVREG user's manual, 14:30747 (R;US)

VOLTAIC CELLS
See ELECTRIC BATTERIES

VOLTAMETRY
Automation
Determination of neptunium by controlled-potential coulometry, 14:30441 (R;US)

W

W CODES
WRATES, 14:31035 (J;US)

W MINUS BOSONS
Particle Identification
Search for top-quark decays to real *W* bosons at the Fermilab Tevatron collider, 14:32578 (J;US)
Particle Production
Search for top-quark decays to real *W* bosons at the Fermilab Tevatron collider, 14:32578 (J;US)

WAPA
See WESTERN AREA POWER ADMINISTRATION

WARFARE
See also CHEMICAL WARFARE
RADIOLOGICAL WARFARE
Computerized Simulation
Nuclear warfare: survival. January 1970-April 1989 (Citations from the NTIS data base). Report for January 1970-April 1989, 14:31902 (R;US)
Markov Process
Simplified anti-submarine warfare problem treated as a steady state Markov process, 14:33015 (J;US)

WASHOUT
Quantitative Chemical Analysis
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)
Sampling
The determination of acid-deposition-related compounds in the lower atmosphere, 14:31925 (R;NL)

WASTE BURIAL
See UNDERGROUND DISPOSAL

WASTE DISPOSAL
See also GROUND RELEASE
RADIOACTIVE WASTE DISPOSAL
SANITARY LANDFILLS
UNDERGROUND DISPOSAL
Environmental Impacts
Installation-Restoration Program. Phase 2. Confirmation/quantification stage 1 for Minot Air Force Base, Minot, North Dakota. Volume 2. Appendices A through F. Final report, September 1985-October 1988, 14:32032 (R;US)
Land Pollution
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
Remedial Action
Annual report on abandoned or uncontrolled hazardous-waste disposal sites and Hazardous Waste Remedial Fund, 1988, 14:30979 (R;US)
Sanitary Landfills
Installation restoration program. Phase 2. Confirmation/quantification stage 2, Moody Air Force Base, Georgia. Appendices. Volume 2. Final report, October 1986-November 1987, 14:32031 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)

WASTE FORMS
Evaluation
Encapsulated cesium and strontium preliminary description of waste form and canister, 14:30615 (R;US)
Fracturing
Model predictions of glass fracturing in canisters during decontamination, 14:30520 (RA;US)
Leaching
Equilibrium leach testing of waste forms containing fuel cladding to evaluate their performance in disposal, 14:30463 (RA;US)
Long-term prediction of radionuclide leaching from waste matrix by finite-slab approximation method, 14:30465 (RA;US)
Performance
Management of cladding hulls and fuel hardware, 14:30477 (RA;US)
Performance Testing
Characterization of radioactive waste forms. Progress report for 1986 Volume 1, 14:30553 (R;FR)
Characterization of radioactive waste forms. Progress report for 1986 Volume 2, 14:30554 (R;FR)
Long term leach behavior of West Valley HLW glasses, 14:30510 (RA;US)
Testing waste forms containing high radionuclide loadings, 14:30468 (RA;US)
Planning
Preliminary plan for disposal-system characterization and long-term performance evaluation of the Waste Isolation Pilot Plant, 14:30590 (R;US)
Radiation Monitoring
Direct assay of drummed evaporator bottoms, dry active waste, and filter cartridges at the Ginna Nuclear Station, 14:30462 (RA;US)
Remote Handling
Pneumatically operated grapple for handling nuclear waste packages, 14:30496 (RA;US)
Stability
Physical stability of cement encapsulated low level radwastes, 14:30466 (RA;US)
Tanks
The Defense Waste Processing Facility, 14:30617 (BA;US)
Testing
NNWSI [Nevada Nuclear Waste Storage Investigation] waste form testing at Argonne National Laboratory: Semiannual report, July–December 1987 (Yucca Mountain Project), 14:30611 (R;US)

WASTE ISOLATION PILOT PLANT
See WIPP

WASTE MANAGEMENT
See also RADIOACTIVE WASTE MANAGEMENT
WASTE DISPOSAL
WASTE PROCESSING
Land Reclamation
Hazardous-waste land treatment, 14:31999 (R;US)
Risk Assessment
Risk-assessment methodology for hazardous-waste management. Final report, 14:31126 (R;US)
WASTE OILS
Liquid Wastes
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 2. Report for April 1987-August 1988, 14:31123 (R;US)
Technology evaluation report, SITE Program Demonstration Test, HAZCON solidification, Douglassville, Pennsylvania. Volume 1. Report for April 1987-August 1988, 14:31122 (R;US)
WASTE PROCESSING
See also ACTIVATED SLUDGE PROCESS
ANAEROBIC DIGESTION
MATERIALS RECOVERY
RADIOACTIVE WASTE PROCESSING
Classification
Evaluation of rotary-drum air classification of shredded and unshredded municipal solid waste. Final report, 14:31149 (R;US)
Gasification
Treatment of hazardous waste in an iron melt process. A joint study, 14:31114 (R;DE)
WASTE PROCESSING PLANTS
See also RESOURCE RECOVERY FACILITIES
Data Acquisition Systems
The data collection system for failure/maintenance at the tritium systems test assembly, 14:32941 (J;US)
WASTE SOLUTIONS
See LIQUID WASTES
WASTE TREATMENT
See WASTE PROCESSING
WASTE WATER
Decontamination
Improved ion exchange method for treatment of slightly contaminated wastewaters, 14:30459 (RA;US)
Materials Recovery
Metals recovery from wastes. January 1977-April 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-April 1989, 14:31127 (R;US)
Pollutants
Analytical procedures for environmental quality control. Volume 3. Technical report, 14:32043 (R;US)
Water Treatment
Identification and treatability of organics in the waste water from oil shale retorting units, 14:30418 (RA;CN)
Industrial testing of retorting waste water treatment in towered biological filtration pond, 14:30419 (RA;CN)
WASTEFORMS
See WASTE FORMS
WATER
See also DRINKING WATER
GROUND WATER
HEAVY WATER
SEAWATER
WASTE WATER
Chemical Reactions
Isotopic dependence of recombination kinetics in water, 14:31573 (J;US)
Cooling
Measurements and calculations on the responses of a NaI(Tl) detector immersed in a water tank containing different radioisotopes, 14:31832 (RA;AT)
Dehydration
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
Microemulsions
Transient liquid crystals in a W/O microemulsion, 14:30290 (R;US)
Molecular Structure
Ab initio molecular orbital study of hydrogen bonding and ion-molecule association in model systems for DNA bases, 14:32187 (BA;US)
Oxidation
Mechanistic aspects of the photooxidation of water at the n-TiO_2/aqueous interface: optically induced transients as a kinetic probe, 14:31564 (J;US)
Phase Diagrams
Dehydration of acetic acid-water mixtures with near critical and supercritical fluid solvents, 14:31454 (J;US)
Photochemical Reactions
Polyelectrolyte-stabilized metal oxide hydrosols as catalysts for the photooxidation of water by zinc porphyrins, 14:31558 (J;US)
Sampling
Experience with a continuously operating water sampling system, 14:31831 (RA;AT)
Solvent Properties
Effects of solvents, axial ligation, and radical cation formation on the V=O stretching Raman frequency in vanadyl porphyrins: implications for peroxidase intermediates, 14:31498 (J;US)
Structure Factors
Molecular dynamics simulation of water beween two ideal classical metal walls, 14:31483 (J;US)
Supercritical State
The destruction of hazardous chemical waste by oxidation in supercritical water, 14:32036 (R;US)
WATER CHEMISTRY
M Codes
MULTEQ: Equilibrium of an electrolytic solution with vapor-liquid partitioning and precipitation: Volume 1: User's manual, Revision 1, 14:30838 (R;US)
WATER COOLANT
See WATER
WATER COOLED REACTORS
See also ACPR REACTOR
BWR TYPE REACTORS
PWR TYPE REACTORS
Accidents
Models for pulmonary lethality and morbidity after irradiation from internal and external sources, 14:30909 (R;US)
WATER HEATERS
Load Management
Analysis of water heater data from Athens load control experiment, 14:30819 (J;US)
WATER INFLUX
Bench-Scale Experiments
Systematic study of distribution characters of infiltration parameters in an experimental basin by nuclear methods, 14:31993 (RA;XA)
Measuring Methods
Gamma ray attenuation as a method to determine the water infiltration and redistribution parameters in soil, 14:31814 (RA;BR)
Tracer Techniques
Systematic study of distribution characters of infiltration parameters in an experimental basin by nuclear methods, 14:31993 (RA;XA)
WATER MODERATOR
See WATER
WATER POLLUTION
Environmental Transport
Contribution of atmospheric nitrate deposition to nitrate loading in the Chesapeake Bay. Final report, 14:32045 (R;US)
Monitoring
Analytical procedures for environmental quality control. Volume 1. Technical report, 14:32041 (R;US)
Analytical procedures for environmental quality control. Volume 2. Technical report, 14:32042 (R;US)
Analytical procedures for environmental quality control. Volume 3. Technical report, 14:32043 (R;US)
Installation restoration program. Phase 2. Confirmation/quantification stage 2, Moody Air Force Base, Georgia. Appendices. Volume 2. Final report, October 1986-November 1987, 14:32031 (R;US)

Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Final report, October 1986-November 1987, 14:32029 (R;US)
Installation-restoration Program. Phase 2. Confirmation/quantification Stage 2, Moody Air Force Base, Georgia. Appendices. Volume 1. Final report, October 1986-November 1987, 14:32030 (R;US)

WATER POLLUTION CONTROL
Adsorbents
Sorption of selected volatile organic constituents of jet fuels and solvents on natural sorbents from gas and solutions phases. Final report, April 1985-September 1987, 14:30298 (R;US)
Aeration
Evaluation of the secondary effects of air stripping, 14:32044 (R;US)
Monitoring
Chesapeake Bay mainstem monitoring program statistical and analytical support contract: final report, Volume 1, 14:32039 (R;US)
Chesapeake bay mainstem monitoring program statistical and analytical support contract: final report, volume 2, 14:32040 (R;US)

WATER PUMPS
Design
Prototype water reuse system, 14:30691 (RA;US)

WATER QUALITY
Ground Water
Impact of water quality on aquifer thermal energy storage, 14:30943 (RA;CA;In English and French)

WATER RESOURCES
Research Programs
Fiscal Year 1987 program report: Alaska Water Research Center, 14:32075 (R;US)

WATER SOURCE HEAT PUMPS
Economic Analysis
Groundwater heat pumps in combination with low-temperature natural heat sources. Economical and technical aspects, 14:30953 (RA;CA;In English and French)
Technology Assessment
Heat pumps, 14:30778 (RA;US)

WATER TREATMENT PLANTS
Geothermal Process Heat
Industrial applications, 14:30782 (RA;US)

WATER VAPOR
Interactions
Time-of-flight mass spectrometer for investigating hydrogen isotope interactions, 14:32954 (J;US)

WATER WAVES
Forecasting
Evaluation of wave forecasting models and forecast wind fields in the Canadian context, 14:32440 (R;CA)
Mathematical Models
Evaluation of wave forecasting models and forecast wind fields in the Canadian context, 14:32440 (R;CA)

WATERBORNE PARTICLES
See PARTICULATES

WAVEGUIDES
Design
Damped accelerator structures for future linear $e^{\pm}$ colliders, 14:31772 (R;US)
Electromagnetic Fields
Analysis of a probe-metallic sleeve feed system for a rectangular waveguide, 14:31615 (R;US)

WAZ 16
See NICKEL BASE ALLOYS

WEAPONS
See also BIOLOGICAL WARFARE AGENTS
CHEMICAL WARFARE AGENTS
DIRECTED-ENERGY WEAPONS
NUCLEAR WEAPONS
Design
Physics Division progress report, October 1, 1986–September 30, 1987, 14:33025 (R;US)

WECS
See WIND TURBINES

WELDED JOINTS
Bonding
Weld overlay disbonding, 14:31232 (R;CA)
Fatigue
Effects of attachment thickness and weld profile on fatigue life of welded joints, 14:31196 (R;CA)
Fracture Mechanics
Integrity of austenitic stainless steel piping welds for nuclear service, 14:30869 (R;BR)
Physical Radiation Effects
Effects of irradiation on K_{Ic} curves for high-copper welds, 14:31183 (R;US)
Reactor Components
Integrity of austenitic stainless steel piping welds for nuclear service, 14:30869 (R;BR)

WELDS
See WELDED JOINTS

WELL COMPLETION
Technology Assessment
Drilling and well construction, 14:30768 (RA;US)

WELL DRILLING
Drilling and well construction, 14:30768 (RA;US)

WELLS
See also GEOTHERMAL WELLS
INJECTION WELLS
NATURAL GAS WELLS
OIL WELLS
Inspection
The California Division of Oil and Gas underground injection control program: A peer review, 14:30286 (R;US)

WEST GERMANY
See FEDERAL REPUBLIC OF GERMANY

WESTERN AREA POWER ADMINISTRATION
Program Management
Annual site environmental report for calendar year 1988, 14:30805 (R;US)

WET DEPOSITION
See WASHOUT

WETLANDS
Land Reclamation
Reclamation options for abandoned commercial peatlands, 14:30276 (R;CA;In English and French)
Testing
Testing station at Soesdala. Experiments concerning energy forest on organogenic soil (exploited peatland), 14:30741 (R;SE;In Swedish)

WETTABILITY
Surfaces
Wetted solid - a generalization of Plateau's problem and its implications for sintered materials, 14:31325 (R;DK)

WHEAT
Radionuclide Kinetics
Radiocesium in wheat of the Po plain, 14:31983 (R;FR;In Italian)

WHEY
Contamination
Radioactivity in milk and milk products from the Chernobyl accident, 14:32361 (RA;AT;In German)

WHITE DWARF STARS
Ultraviolet Spectra
Ultraviolet emission of accreting magnetic white dwarfs, 14:32448 (RA;FR)

WHITE HOLES
Space-Time
Dray–'t Hooft geometries and the death of white holes, 14:32469 (J;US)

WHOLE-BODY COUNTERS
Calibration
Comparative measurements on 30 whole-body counters, 14:31843 (RA;AT;In German)

WHOLE-BODY IRRADIATION
Dosimetry
Whole-body irradiation at I.P.O.F.G., Lisboa: technic and dosimetry, 14:32216 (RA;BR;In Portuguese)
Radiation Doses
Kerma rates and whole-body absorbed dose rates for immersion in a semi-infinite cloud, 14:32766 (RA;AT)
Radiotherapy
Whole-body irradiation at I.P.O.F.G., Lisboa: technic and dosimetry, 14:32216 (RA;BR;In Portuguese)
WILD ANIMALS
Population Dynamics
Wildlife management assistance report: Progress report, July 1, 1988–June 30, 1989, 14:32027 (R;US)
WIND
Complex Terrain
Project WIND, phase IV, dispersion study. Aerial smoke plume observations and surface layer turbulence measurements. Part 1, 14:31909 (R;DK)
WIND ENERGY CONVERSION SYSTEMS
See WIND TURBINES
WIND FARMS
See WIND TURBINE ARRAYS
WIND GENERATORS
See ELECTRIC GENERATORS
WIND TURBINES
WIND POWER
Research Programs
Wind Energy Program Summary: Volume 2: Research summaries, fiscal year 1988, 14:30784 (R;US)
Rotors
Verification analysis of the toroidal accelerator rotor platform wind energy conversion system. Summary report, 14:30789 (R;US)
WIND POWER INDUSTRY
Denmark
Project for the development of competitive wind powered plants, 14:30787 (R;DK;In Danish)
WIND TURBINE ARRAYS
Design
Verification analysis of the toroidal accelerator rotor platform wind energy conversion system. Summary report, 14:30789 (R;US)
WIND TURBINES
See also HORIZONTAL AXIS TURBINES
Denmark
Project for the development of competitive wind powered plants, 14:30787 (R;DK;In Danish)
International Energy Agency
IEA R and D Wind Energy. Annual report 1988, 14:30785 (R;SE)
Turbine Blades
Project K 30 meter glass fiber wind turbine-blade. Technological description, 14:30786 (R;DK;In Danish)
WINDOWS
Research Programs
Windows and lighting program: FY 1988, annual report, 14:31069 (R;US)
WIPP
Site Characterization
The delineation of the disturbed rock zone surrounding excavations in salt, 14:30579 (R;US)
Standards
Leach testing of simulated Hanford Waste Vitrification Plant reference glass HW-39, 14:30573 (R;US)
WIRE SPARK CHAMBERS
Service Life
Study of straw chamber lifetime with argon ethane, 14:31852 (R;US)
WIRES
Electromagnetic Fields
Recent improvements to the model for wire antennas in the code NEC [Numerical Electromagnetics Code], 14:31879 (R;US)
WOLFRAM
See TUNGSTEN
WOMEN
Pelvis
Computed tomography and MRI of the female pelvis, 14:32293 (RA;DD)
Radiotherapy
Gonadal doses in various radiotherapeutic procedures, 14:32352 (RA;AT)
WOOD
Deformation
Local isotropic/global orthotropic finite element technique for modeling the crush of wood in impact limiters, 14:31614 (R;US)
Electrical Properties
The electrical characteristics of wood poles, 14:32404 (R;CA)
Gamma Spectroscopy
Method for the retrospective determination of contamination from the Chernobyl accident. Gamma spectroscopic evaluation of woodpiles, 14:32018 (RA;AT;In German)
Gasification
Construction of a simplified wood gas generator for fueling internal combustion engines in a petroleum emergency, 14:30674 (R;US)
WOOD BURNING APPLIANCES
Operating Cost
Large scale wood heating, 14:30673 (R;CA)
WOOD PRODUCTS INDUSTRY
See also FURNITURE INDUSTRY
PAPER INDUSTRY
Fuel wood and charcoal research in the dominican republic. Results of the wood fuel development program, 14:30984 (R;DO)
Geothermal Process Heat
Industrial applications, 14:30782 (RA;US)
Hazardous Materials
Health-hazard evaluation determination report No. 75-19-276, Masonite Corporation, Evendale, Ohio, 14:31959 (R;US)
WOOD WASTES
Compacting
Task report: Stockholm no 1564/881110. Technique - Fuel preparation, 14:30675 (R;SE;In Swedish)
Waste Management
An air management strategy for Williams Lake, 14:31915 (R;CA)
Woodwaste incineration and air quality in Williams Lake, 14:31914 (R;CA)
WORKERS
See PERSONNEL
WORKING (MATERIALS)
See MATERIALS WORKING

X

X RADIATION
See also HARD X RADIATION
Cosmic Ray Sources
Coded mask telescope for observations of X and gamma ray sources in the Southern sky, 14:31797 (RA;BR)
Reflection
Simulated response of multilayer x-ray reflectors to damaging fluxes, 14:31238 (J;US)
Silica Gel
SAXS study of silica sols, gels and glasses obtained by the sol gel process, 14:32748 (R;BR;In Portuguese)
Small Angle Scattering
SAXS study of silica sols, gels and glasses obtained by the sol gel process, 14:32748 (R;BR;In Portuguese)
Southern Hemisphere
Coded mask telescope for observations of X and gamma ray sources in the Southern sky, 14:31797 (RA;BR)
X-2830 RESONANCES
See MESONS
X-RASERS
See X-RAY LASERS

X-RAY DIFFRACTION
Computer Codes
Operating instructions for the collection and analysis of x-ray diffraction data using a position sensitive detector system, 14:32782 (R;GB)
Position Sensitive Detectors
Operating instructions for the collection and analysis of x-ray diffraction data using a position sensitive detector system, 14:32782 (R;GB)
X-RAY EQUIPMENT
See also X-RAY SOURCES
Biological Shielding
Calculation of requirements respectively of radiation protection as condition for the permission of medical X-ray plants, 14:30649 (RA;AT)
Measuring Methods
Calculation of requirements respectively of radiation protection as condition for the permission of medical X-ray plants, 14:30649 (RA;AT)
Microscopes
Compact scanning soft-x-ray microscope using a laser-produced plasma source and normal-incidence multilayer mirrors, 14:31885 (J;US)
Specifications
The Saturn x-ray framing camera, 14:31873 (R;US)
X-RAY LASERS
Design
Theoretical studies and algorithm development for x-ray lasers: Final report, June 15, 1988–February 15, 1989, 14:31634 (R;US)
Feasibility Studies
Measurements of gain and line broadening in lithiumlike aluminum, 14:32895 (J;US)
Optical Pumping
Z-pinch modeling at Sandia National Laboratories, 14:31631 (R;US)
X-RAY RADIOGRAPHY
Radiation Doses
Radiation burden in X-ray examinations of facial skull, 14:32351 (RA;AT;In German)
X-RAY SOURCES
Diagnostic Techniques
A one-dimensional scintillator camera for the SATURN x-ray simulation accelerator, 14:31851 (R;US)
X-RAY SPECTRA
Hyperfine Structure
Comment on X-ray production by Pt and Os projectiles moving in thick Fe Targets with E/sub p/ = 17.30 MeV, 14:32783 (R;AU)
X-RAY SPECTROMETERS
Spatial Resolution
High-resolution bent-crystal spectrometer for the ultrasoft x-ray region, 14:32890 (J;US)
X-RAY SPECTROSCOPY
Ionization Chambers
Surface-extended x-ray-absorption fine-structure experiments at atmospheric pressure by means of a photocathode proportional counter with monolayer sensitivity, 14:31890 (J;US)
XENON IONS
Gases
Average energy to create an ion pair in gases by xenon, lead and uranium ions for energy between 3 and 5 MeV/amu, 14:32502 (RA;BR)
XYLOSE
Fermentation
Cloning of the xylulokinase gene for improved yeast xylose fermentation. I.Cloning the yeast xylulokinase gene by complementation of E. coli xylulokinase mutation, 14:30733 (RA;US)
Fusarium strain development and selection for enhancement of ethanol production, 14:30671 (RA;US)
Identification and evaluation of SERI-NF1 fungus for ethanol production from xylose fermentation, 14:30654 (R;US)
Overproduction of xylose isomerase and control of xy1A copy number in large-scale fermentations of Escherichia coli, 14:30732 (RA;US)
Simultaneous fermentation and isomerization of xylose to ethanol, 14:30669 (RA;US)
Xylose fermentation analysis, 14:30668 (RA;US)

Y

Y*RESONANCES
See BARYONS
YEASTS
See also CANDIDA
SACCHAROMYCES
Growth
Modeling of Brettanomyces clausenii growth on mixtures of glucose and cellobiose, 14:30712 (RA;US)
Simultaneous saccharification and fermentation of cellulose and wheat straw to ethanol: evaluation of thermotolerant yeast and B-glucosidase supplementation, 14:30667 (RA;US)
YIELD (CHEMICAL REACTION)
See CHEMICAL REACTION YIELD
YTTERBIUM ALLOYS
Fermi Level
Fermi-level tuning in $Y_{1-x}U_xPd_3$, 14:31265 (J;US)
YTTERBIUM IONS
Gain
Gain measurements at 5nm in nickel like ytterbium, 14:31179 (R;FR)
Soft X Radiation
Gain measurements at 5nm in nickel like ytterbium, 14:31179 (R;FR)
YTTRIUM 89 TARGET
Proton Reactions
Isobaric yield curves at *A*=72 from the spallation of medium mass isotopes by intermediate energy protons, 14:32671 (J;US)
YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES
YTTRIUM COMPOUNDS
YTTRIUM COMPOUNDS
See also YTTRIUM OXIDES
Chemical Reactions
Probing metal cluster formation in NaY zeolite by ^{129}Xe NMR, 14:31508 (J;US)
Cuprates
Superconducting thin films composites and junctions. Annual report, 1 October 1987-31 October 1988, 14:31266 (R;US)
Electron Spin Resonance
Electron paramagnetic resonance in the orthorhombic and tetragonal phases of YBa/sub 2/Cu/sub 3/O/sub x/, 14:32795 (R;BR;In Portuguese)
Electronic Structure
Photoemission spectroscopy of single crystal HTSC materials: A Fermi liquid electronic structure, 14:31393 (R;US)
Microstructure
The study of structure-processing-property relations in copper oxide-based high T_c superconductors: Progress report, July 1, 1988–March 1, 1989, 14:31278 (R;US)
YTTRIUM OXIDES
Barium
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Chemical Vapor Deposition
Chemical vapor deposition of $YBa_2Cu_3O_{7-x}$ superconducting films, 14:31296 (J;US)
Compacting
Observation of crystallographic texture and J/sub c/ anisotropy in bulk shock-compacted YBa/sub 2/Cu/sub 3/O/sub 7-x/ powders, 14:31297 (J;US)
Copper
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
Crystal Structure
X-ray study of in-plane epitaxy of $YBa_2Cu_3O_x$ thin films, 14:31311 (J;US)

Electrodynamics
Nonlinear electrodynamics in the granular superconductor $YBa_2Cu_3O_7$: Experiments and interpretation, 14:31307 (J;US)
Magnetization
Flux creep in $Y(Gd)Ba_2Cu_3O_{7-\delta}$: Magnetic field dependence, 14:31306 (J;US)
Physical Properties
Preparation and Raman analysis of single-phase $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$, 14:31312 (J;US)
Superconductors
Plastic deformation of YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor compound, 14:31281 (R;BR;In Portuguese)
X-Ray Spectra
Distorted chain sites for Co- and Fe-substituted $YBa_2Cu_3O_{7-\delta}$, 14:31308 (J;US)

YUCCA MOUNTAIN
Site Characterization
Experiments in rock mechanics for the site characterization of Yucca Mountain, 14:30583 (R;US)
Relevance of partial saturation to the mechanical behavior of tuffs, 14:30581 (R;US)

YUGOSLAVIA R-B REACTOR VINCA
See R-B REACTOR

Z

ZEOLITES
Catalytic Effects
Analytical electron microscopy of catalyst promoters, poisons, and active species: Progress report, [July 1986–September 1988], 14:31470 (R;US)
Chemical Preparation
Probing metal cluster formation in NaY zeolite by ^{129}Xe NMR, 14:31508 (J;US)
Molecular Structure
Spin echo NMR of cobalt zeolite catalysts: control of particle size and structure, 14:31249 (J;US)
Sorptive Properties
Dynamics of molecular hydrogen adsorbed in CoNa-A zeolite, 14:31545 (J;US)

ZINC
Separation Processes
Liquid-membrane-permeation and its experiences in pilot-plant and industrial scale, 14:31429 (J;US)
Sorptive Properties
Multicycle testing of zinc ferrite, 14:30250 (R;US)

ZINC 68
Alpha Decay
Application of the Reich-Moore formalism to description of interresonance interference in the α-decay channel of /sup 68/Zn and /sup 146/Nd compound nuclei, 14:32731 (RA;SU;In Russian)

ZINC ALLOYS
Electrical Properties
Microscopic real-space approach to the theory of metallic glasses, 14:31248 (J;US)
Mechanical Properties
Lithium depletion in precipitate free zones (PFZ's) in Al-Li base alloys, 14:31239 (J;US)

ZINC CHLORIDES
Chemical Reactions
Treatment of synthetic crudes with metal chlorides and metal carbonyls, 14:30653 (J;US)

ZINC COMPLEXES
Electron Transfer
Effect of triplet spin dynamics memory in electron-transfer reactions. Fourier transform-electron paramagnetic resonance spectroscopy, 14:31565 (J;US)

ZINC COMPOUNDS
See also ZINC OXIDES
ZINC SELENIDES
Photochemical Reactions
Polyelectrolyte-stabilized metal oxide hydrosols as catalysts for the photooxidation of water by zinc porphyrins, 14:31558 (J;US)
Separation Processes
Comparison of bulk, emulsion, thin sheet supported, and hollow fiber supported liquid membranes in macrocycle-mediated cation separations, 14:31428 (J;US)

ZINC OXIDES
Catalytic Effects
Analytical electron microscopy of catalyst promoters, poisons, and active species: Progress report, [July 1986–September 1988], 14:31470 (R;US)
Photochemistry
Photoelectrochemistry and photochemistry of sensitized semiconductor surfaces, 14:31293 (BA;US)

ZINC SELENIDES
Chemical Bonds
Bonding of Se and ZnSe to the Si(100) surface, 14:31379 (J;US)
Deposition
Bonding of Se and ZnSe to the Si(100) surface, 14:31379 (J;US)

ZINC-BROMINE BATTERIES
Research Programs
Flow batteries, 14:30967 (BA;US)

ZINC-CHLORINE BATTERIES
Flow batteries, 14:30967 (BA;US)

ZION STATION UNIT-1
See ZION-1 REACTOR

ZION STATION UNIT-2
See ZION-2 REACTOR

ZION-1 REACTOR
Reactor Cooling Systems
Numerical simulation of natural circulation phenomena in a PWR during TMLB' transients prior to core damage, 14:30877 (R;US)

ZION-2 REACTOR
Numerical simulation of natural circulation phenomena in a PWR during TMLB' transients prior to core damage, 14:30877 (R;US)

ZIRCALOY
See also ALLOY-ZR98SN-4
Crack Propagation
Iodine stress corrosion cracking in Zircaloy, 14:31204 (R;BR)
Plates
Iodine stress corrosion cracking in Zircaloy, 14:31204 (R;BR)

ZIRCON
Natural Radioactivity
Study of the effect of natural radiation damage in crystal using thermoluminescence fission track etching and x-ray diffraction, 14:31322 (RA;BR)
Ore Concentrates
Potential of heavy minerals in the Valenca-Itacare, Bahia (Brazil) region - Sampling characterization and ore processing, 14:31388 (R;BR;In Portuguese)
Physical Radiation Effects
Study of the effect of natural radiation damage in crystal using thermoluminescence fission track etching and x-ray diffraction, 14:31322 (RA;BR)
Zirconium Oxides
Potential of heavy minerals in the Valenca-Itacare, Bahia (Brazil) region - Sampling characterization and ore processing, 14:31388 (R;BR;In Portuguese)

ZIRCONIUM
Alloy Nuclear Fuels
Uranium alloys for using in fast breeder reactors, 14:31189 (R;BR;In Portuguese)
Aqueous Solutions
Influences of the HNO/sub 3/ initial concentration at aqueous phase and the temperature on zirconium extraction, 14:31385 (R;BR;In Portuguese)
Radiolysis
Influence of radiolytic degradation products from organic phase, 14:31569 (R;BR;In Portuguese)
Solvent Extraction
Influences of the HNO/sub 3/ initial concentration at aqueous phase and the temperature on zirconium extraction, 14:31385 (R;BR;In Portuguese)

Uranium
Uranium alloys for using in fast breeder reactors, 14:31189 (R;BR;In Portuguese)
ZIRCONIUM 90 TARGET
Zirconium 96 Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
ZIRCONIUM 91
Mass Transfer
Uranium and zirconium mass transfer testing of 5.5-cm-diam centrifugal contactors, 14:30446 (J;US)
ZIRCONIUM 96 REACTIONS
Deep Inelastic Heavy Ion Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Heavy Ion Fusion Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Multi-Nucleon Transfer Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
Transfer Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
ZIRCONIUM 96 TARGET
Tin 124 Reactions
Correlations between transfer and fusion in heavy ion collisions at the Coulomb barrier, 14:32672 (R;DE;In German)
ZIRCONIUM ALLOYS
See also ZIRCONIUM BASE ALLOYS
Creep
Radiation effects on time-dependent deformation: Creep and growth, 14:31224 (R;US)
Electrical Properties
Microscopic real-space approach to the theory of metallic glasses, 14:31248 (J;US)
Formation Heat
Energetics of transition-metal alloy formation: Ti, Zr, and Hf alloyed with the heavier 4*d* and 5*d* elements, 14:31250 (J;US)
Mechanical Properties
Investigation and synthesis of high-temperature and increased-stiffness RSP aluminum alloys. Final technical report, 1 October 1985-30 September 1988, 14:31175 (R;US)
ZIRCONIUM BASE ALLOYS
See also ZIRCALOY
Hydrogenation
Amorphization of Zr_3Al by hydrogenation and subsequent electron irradiation, 14:31185 (R;US)
ZIRCONIUM COMPOUNDS
See also ZIRCONIUM NITRIDES
ZIRCONIUM OXIDES
Nuclear Magnetic Resonance
Characterization of interstitial hydrogen within metal clusters in $Zr_6Cl_{12}H$ and $ZrClO_xH_y$ by solid-state nuclear magnetic resonance, 14:31518 (J;US)
ZIRCONIUM NITRIDES
Oxidation
Raman spectroscopic observation of laser-induced oxidation of transition-metal borides, carbides, and nitrides, 14:31294 (J;US)
ZIRCONIUM OXIDES
Phase Studies
Metal/zirconia interfacial reactions in solid oxide fuel cell anodes, 14:31048 (BA;US)
Thermodynamics
Metal/zirconia interfacial reactions in solid oxide fuel cell anodes, 14:31048 (BA;US)
Thin Films
Metal/zirconia interfacial reactions in solid oxide fuel cell anodes, 14:31048 (BA;US)
ZONES (AURORAL)
See AURORAL ZONES

Contract Number Index

Numbers assigned to DOE contracts announced in documents in this publication are listed. Contract numbers are sorted alphanumerically and list the primary corporate author of the document cited, the citation number, and the report number or other document identification.

Contract No.	Abstract No.	Report No.
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	14:30245	BNL–41390
	14:30454	BNL–42564
	14:30455	BNL-NUREG–42595
	14:30766	BNL–42663
	14:30895	BNL-NUREG–42259
	14:30985	BNL–42334
	14:30986	BNL–52165
	14:31056	BNL–42502
	14:31588	BNL–42275
	14:31712	DOE/FTR–9013257
	14:31735	DOE/FTR–9011587
	14:31736	DOE/FTR–9012800
	14:31737	DOE/FTR–9013610
	14:31803	BNL–42683
	14:31804	BNL–42688
	14:31916	BNL–42277
	14:32177	PATENTS-US–A7212545
	14:32367	BNL–42416
	14:32542	BNL–34518
	14:32545	BNL–42535
	14:32580	BNL–42537
	14:32581	BNL–42715
	14:32996	DOE/FTR–9013613
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering and Systems Technology	
	14:30824	NUREG/CR–5244
	14:31250	Published article
	14:31258	Published article
	14:31303	Published article
	14:31369	Published article
	14:31370	Published article
	14:31411	Published article
	14:31572	Published article
	14:31709	CONF-880862–
	14:31858	CONF-880862–
	14:31978	Published article
	14:32355	Published article
	14:32356	Published article
	14:32550	CONF-880862–
	14:32555	CONF-880862–
	14:32559	CONF-880862–
	14:32564	CONF-880862–
	14:32567	CONF-880862–
	14:32594	CONF-880862–
	14:32606	Published article
	14:32609	Published article
	14:32626	Published article
	14:32745	Published article
	14:32818	Published article
	14:33016	Published article
AC02-76CH03000	**Fermi National Accelerator Lab., Batavia, IL (USA)**	
	14:31713	FNAL/C–89/89
	14:31714	FNAL/C–89/94
	14:31715	FNAL/C–89/103
	14:31811	FNAL/C–89/109
	14:32544	FNAL/C–89/70
AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
	14:32507	PPPL–2617
	14:32837	PPPL–2619
	14:32881	PPPL–2609
	14:32882	PPPL–2612
	14:32883	PPPL–2620
	14:32884	PPPL–2622
	14:32885	PPPL–2624
	14:32928	PPPL–2621
AC02-76ER01112	**Sandia National Labs., Albuquerque, NM (USA)**	
	14:32462	SAND–89-1234C
AC02-76ER01198	**Illinois Univ., Urbana, IL (USA)**	
	14:31184	CONF-881155–73
	Illinois Univ., Urbana, IL (USA). Dept. of Physics	
	14:32785	CONF-8704380–1
	14:31352	Published article
	14:31360	Published article
	14:31380	Published article
	14:31503	Published article
	14:31504	Published article
	14:32196	Published article
AC02-76ER02220	**Institute for Advanced Study, Princeton, NJ (USA)**	
	14:32543	DOE/ER/02220–1
AC02-76ER02271	**Columbia Univ., New York, NY (USA)**	
	14:32582	DOE/ER/02271–112
	14:32574	Published article
AC02-76ET25108	**Franklin Inst. Research Labs., Philadelphia, PA (USA)**	
	14:31279	DOE/ET/25108–T1
	14:31358	Published article
AC02-78ET53082	**Wisconsin Univ., Madison, WI (USA). Torsatron/Stellarator Lab.**	
	14:32903	DOE/ET/53082–1
AC02-79ER10353	**New York Univ., NY (USA). Courant Inst. of Mathematical Sciences**	
	14:32700	DOE/ER/10353–T1
	14:32701	DOE/ER/10353–T2
	14:32702	DOE/ER/10353–T3
AC02-79ET10815	**Tennessee Univ., Tullahoma, TN (USA). Space Inst.**	
	14:31041	DOE/ET/10815–127
	14:32048	Published article
	14:31498	Published article
AC02-82ER40063	**Smithsonian Astrophysical Observatory, Cambridge, MA (USA)**	
	14:32444	DOE/ER/40063–13
AC02-83CH10093	**Utah Univ., Salt Lake City, UT (USA). Dept. of Mechanical Engineering**	
	14:30790	SERI/STR–217-3476
	Solar Energy Research Inst., Golden, CO (USA)	
	14:30700	SERI/SP–220-3458
	14:30702	DOE/CH/10093–53

Contract No.	Abstract No.	Report No.
	14:30703	DOE/CH/10093–54
	14:30708	SERI/PR–211-3483
	14:30738	SERI/TR–213-3472
	14:30758	SERI/TP–254-3453
	14:30784	DOE/CH/10093–42
	14:31091	SERI/TP–254-3049
	14:31092	SERI/TP–254-3478
	14:31109	DOE/CH/10093–31
	14:30709	SERI/SP–211-3488
	14:30744	Published article
	14:30745	Published article
	14:31679	Published article
AC02-83ER13083	**Missouri Univ., Rolla, MO (USA)**	
	14:30290	DOE/ER/13083–T3
	14:32550	CONF-880862–
	14:32559	CONF-880862–
	14:32564	CONF-880862–
AC02-86ER40306	**Wisconsin Univ., Madison, WI (USA)**	
	14:31596	DOE/ER/40306–1
AC02-87ER40372	**Notre Dame Univ., IN (USA)**	
	14:31810	DOE/ER/40372–02
	14:32199	Published article
AC03-76SF00098	**Lawrence Berkeley Lab., CA (USA)**	
	14:30706	LBL–25317
	14:30772	LBL–26898
	14:30971	LBL–26585
	14:30996	LBL–25611
	14:31038	LBL–25558
	14:31069	LBL–26587
	14:31283	LBL–27094
	14:31394	LBL–27014
	14:31551	LBL–27123
	14:31599	LBL–25735
	14:31697	LBL–27059
	14:31721	LBL–25961
	14:31722	LBL–27092
	14:31758	LBL–25424
	14:31759	LBL–25610
	14:31760	LBL–25951
	14:31761	LBL–25953
	14:31762	LBL–25986
	14:31763	LBL–26244
	14:31764	LBL–26247
	14:31765	LBL–26282
	14:31766	LBL–27062
	14:31825	LBL–27063
	14:31929	LBL–24212
	14:31930	LBL–25348-Rev.
	14:31931	LBL–26584
	14:31932	LBL–26890
	14:31933	LBL–27011
	14:32210	LBL–27196
	14:32417	LBL–25586
	14:32432	LBL–26595
	14:32433	LBL–26868
	14:32618	LBL–25784
	14:32670	LBL–27019
	14:32739	LBL–27093
	14:32801	LBL–26220
	14:32924	LBL–25984
	14:32925	LBL–27219
	14:30567	LBL–25769
	14:31307	Published article
	14:31500	Published article
	14:31502	Published article
	14:31508	Published article
	14:31523	Published article
	14:31525	Published article
	14:31537	Published article
	14:31578	Published article
	14:32357	Published article
	14:32554	CONF-880862–
	14:32563	CONF-880862–
	14:32574	Published article
	14:32659	Published article
	14:32693	Published article
	14:32805	Published article
	14:32856	Published article
	14:33019	Published article
AC03-76SF00472	**California Univ., Davis, CA (USA). School of Veterinary Medicine**	
	14:32394	UCD–472-133
AC03-76SF00515	**Stanford Linear Accelerator Center, Menlo Park, CA (USA)**	
	14:31702	SLAC–341
	14:31703	SLAC-PUB–4849
	14:31704	SLAC-PUB–4851
	14:31705	SLAC-PUB–4894
	14:31706	SLAC-PUB–4975
	14:31723	SLAC-PUB–4835
	14:31724	SLAC-PUB–4872
	14:31725	SLAC-PUB–4898
	14:31726	SLAC-PUB–4924
	14:31727	SLAC-PUB–4933
	14:31728	SLAC-PUB–4934
	14:31768	SLAC-PUB–4719-Rev.
	14:31769	SLAC-PUB–4743
	14:31770	SLAC-PUB–4850
	14:31771	SLAC-PUB–4861
	14:31772	SLAC-PUB–4865
	14:31773	SLAC-PUB–4866
	14:31774	SLAC-PUB–4867
	14:31775	SLAC-PUB–4883
	14:31776	SLAC-PUB–4902
	14:31777	SLAC-PUB–4921
	14:31778	SLAC-PUB–4922
	14:31779	SLAC-PUB–4925
	14:31780	SLAC-PUB–4965
	14:31781	SLAC-PUB–4967
	14:31791	SLAC-PUB–4905
	14:31792	SLAC-PUB–4906
	14:31793	SLAC-PUB–4913
	14:31794	SLAC-PUB–4914
	14:31852	SLAC-PUB–4857
	14:31853	SLAC-PUB–4940
	14:31854	SLAC-PUB–4956
	14:31855	SLAC-PUB–4966
	14:32548	SLAC–342
	14:32549	SLAC-PUB–4821
	14:32468	Published article
	14:32551	CONF-880862–
	14:32558	CONF-880862–
	14:32574	Published article
	14:32577	Published article
	14:32593	Published article
AC03-81ER40050	**Lawrence Livermore National Lab., CA (USA)**	
	14:32842	UCRL–101001
	14:32528	Published article
AC03-89ER51114	**General Atomics, San Diego, CA (USA)**	
	14:32870	GA-A–19662
	14:32871	GA-A–19663
AC04-76DP00613	**Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.**	
	14:31927	KCP–613-4101
AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
	14:30285	SAND–89-0341
	14:30451	SAND–89-0808C
	14:30576	SAND–86-2357
	14:30578	SAND–88-1156
	14:30579	SAND–88-2230C
	14:30580	SAND–88-2342C
	14:30581	SAND–88-2521C

Contract No.	Abstract No.	Report No.
	14:30582	SAND–88-2535C
	14:30583	SAND–88-2650C
	14:30584	SAND–88-2734C
	14:30585	SAND–88-2744C
	14:30586	SAND–88-2778C
	14:30587	SAND–88-2823C
	14:30588	SAND–88-2826C
	14:30589	SAND–88-3410C
	14:30590	SAND–89-0178
	14:30591	SAND–89-0559C
	14:30592	SAND–89-0560C
	14:30593	SAND–89-0608C
	14:30594	SAND–89-0807C
	14:30595	SAND–89-0915C
	14:30596	SAND–89-0921C
	14:30597	SAND–89-0922C
	14:30598	SAND–89-0935C
	14:30599	SAND–89-0937C
	14:30600	SAND–89-0962C
	14:30601	SAND–89-1213C
	14:30602	SAND–89-1224C
	14:30603	SAND–89-1257C
	14:30748	SAND–88-7036-Pt.2
	14:30749	SAND–88-7042
	14:30751	SAND–88-3027C
	14:30752	SAND–89-0424C
	14:30753	SAND–89-0463
	14:30921	SAND–89-1194C
	14:31227	SAND–89-0264C
	14:31228	SAND–89-0489
	14:31229	SAND–89-0676C
	14:31287	SAND–88-1112C
	14:31335	SAND–88-3118
	14:31336	SAND–89-0842
	14:31475	SAND–89-0861C
	14:31583	SAND–88-1296C
	14:31603	SAND–88-2115C
	14:31604	SAND–88-2287C
	14:31605	SAND–88-2341C
	14:31606	SAND–88-2827C
	14:31607	SAND–89-0157C
	14:31608	SAND–89-0411C
	14:31609	SAND–89-0671
	14:31610	SAND–89-0914C
	14:31611	SAND–89-0923C
	14:31612	SAND–89-0938C
	14:31613	SAND–89-1222C
	14:31614	SAND–89-1223C
	14:31615	SAND–89-7052C
	14:31631	SAND–89-0503C
	14:31632	SAND–89-0953C
	14:31657	SAND–88-2741C
	14:31672	SAND–88-3356C
	14:31673	SAND–88-3399C
	14:31674	SAND–89-0020C
	14:31675	SAND–89-0486C
	14:31676	SAND–89-1085C
	14:31701	SAND–89-0069C
	14:31767	SAND–89-0298
	14:31851	SAND–89-0188C
	14:31865	SAND–88-2907
	14:31866	SAND–88-3153
	14:31867	SAND–88-3388C
	14:31868	SAND–88-3389C
	14:31869	SAND–88-3465C
	14:31870	SAND–88-7169C
	14:31871	SAND–89-0242
	14:31872	SAND–89-0267C
	14:31873	SAND–89-0301C
	14:31874	SAND–89-0337C
	14:31875	SAND–89-0593
	14:31876	SAND–89-1263C
	14:31892	SAND–88-2098C
	14:31895	SAND–88-2813C
	14:31896	SAND–89-0512
	14:31903	SAND–88-3341
	14:32434	SAND–88-2943C
	14:32462	SAND–89-1234C
	14:32692	SAND–89-1101C
	14:32929	SAND–88-2057
	14:32930	SAND–89-0031C
	14:32931	SAND–89-0070C
	14:33009	SAND–88-0173
	14:33010	SAND–88-3016
	14:33022	SAND–89-0095C
	14:33023	SAND–89-0909C
	14:30747	SAND–88-7036-Pt.1
	Los Alamos National Lab., NM (USA)	
	14:31331	LA-UR–89-956
	14:31365	Published article
	14:31373	Published article
	14:31515	Published article
	14:31527	Published article
	14:31557	Published article
	14:31683	Published article
	14:31888	Published article
AC04-76DP03533	**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**	
	14:31226	RFP–4330
	Rockwell International Corp., Golden, CO (USA)	
	14:31225	RFP–4329
AC04-76DR00789	**Sandia National Labs., Livermore, CA (USA)**	
	14:30282	SAND–89-8235
	14:30983	SAND–89-8228
AC04-76EV01013	**USDOE Office of Energy Research, Washington, DC (USA). Office of Health and Environmental Research**	
	14:32395	CONF-8811202–
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications	
	14:30909	NUREG/CR–5351
AC04-88DP43495	**EG and G Mound Applied Technologies, Miamisburg, OH (USA)**	
	14:31864	MLM–3586
	14:31409	Published article
AC05-84ER40150	**Southeastern Universities Research Association, Newport News, VA (USA). Continuous Electron Beam Accelerator Facility**	
	14:31734	DOE/ER/40150–68-Rev.
AC05-84OR21400	**ASEA-ATOM AB, Vaesteraas (Sweden)**	
	14:30870	ORNL/tr–89/7
	Oak Ridge National Lab., TN (USA)	
	14:30247	CONF-890509–1
	14:30248	CONF-8905142–1-Vugraphs
	14:30440	CONF-890604–1
	14:30523	CONF-890207–31
	14:30525	CONF-890631–18
	14:30571	ORNL/TM–10919
	14:30674	ORNL–6404
	14:30701	CONF-890692–1
	14:30791	CONF-890634–1
	14:30797	ORNL/CON–278
	14:30825	ORNL/tr–89/10
	14:31057	CONF-8809314–
	14:31071	ORNL/CON–279
	14:31072	ORNL/M–329/R1
	14:31159	ORNL/M–755
	14:31167	CONF-890692–12
	14:31174	ORNL–6529

Contract No.	Abstract No.	Report No.
	14:31183	CONF-880613–31
	14:31221	ORNL/Sub–86-95900/01
	14:31317	CONF-890426–10
	14:31575	ORNL/M–551/R1
	14:31594	CONF-890676–1
	14:31662	CONF-890277–1
	14:31786	CONF-890560–1
	14:31807	CONF-890379–3
	14:31808	CONF-890379–4
	14:31848	ORNL–6544
	14:31849	ORNL/TM–11199
	14:31901	ORNL/TM–10921
	14:31920	CONF-890692–6
	14:31921	CONF-890692–9
	14:31936	ORNL–6492
	14:31937	ORNL–6521
	14:31995	CONF-890692–5
	14:32021	ORNL/RASA–88/29
	14:32022	ORNL/RASA–89/2
	14:32037	ORNL/TM–10735
	14:32038	ORNL/TM–11135
	14:32211	CONF-8905121–1
	14:32398	ORNL/M–775
	14:32399	ORNL/M–829
	14:32409	ORNL/TM–11081
	14:32419	CONF-8905127–4
	14:32490	CONF-8905141–1
	14:32862	CONF-890403–19
	14:32863	CONF-890403–22
	14:32899	CONF-890403–23
	14:32900	CONF-890403–24
	14:32901	CONF-8905120–10
	14:32965	CONF-890657–2
	14:32966	CONF-8906113–1
	14:32983	CONF-890657–1
	14:32985	CONF-890693–2
	14:32988	CONF-8905135–1
	14:32989	CONF-8906113–2
	14:33007	ORNL/TM–11068
	14:33008	ORNL/TM–11079
	14:33028	ORNL/TM–11143
	14:33029	ORNL/TM–11160
	14:30570	ORNL/Sub–89-21242/1
	Oak Ridge National Lab., TN (USA). Computing and Telecommunications Div.	
	14:30569	ORNL/CSD/TM–251
	Sandia National Labs., Albuquerque, NM (USA)	
	14:30577	SAND–87-0754
	Oak Ridge National Lab., TN (USA). Carbon Dioxide Information Analysis Center	
	14:33021	ORNL/CDIAC–26
	American Nuclear Society (USA). Fuel Cycle and Waste Management Div.	
	14:30438	CONF-860905–Vol.1
	14:31590	CONF-860905–Vol.1
	14:30446	CONF-871038–
	14:31253	Published article
	14:31262	Published article
	14:31294	Published article
	14:31311	Published article
	14:31361	Published article
	14:31408	Published article
	14:31409	Published article
	14:31521	Published article
	14:31526	Published article
	14:31538	Published article
	14:31658	Published article
	14:31882	Published article
	14:32005	Published article
	14:32023	Published article
	14:32024	Published article
	14:32198	Published article
	14:32516	Published article
	14:32524	Published article
	14:32600	CONF-880862–
	14:32815	Published article
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
	14:30448	CONF-890631–1
	14:31597	K/CSD/INF–88/20
	14:31907	K/D–5694
	14:32999	K/DSRD–96
	Oak Ridge National Lab., TN (USA)	
	14:30432	K/ITP–269/P1
	Oak Ridge Gaseous Diffusion Plant, TN (USA). International Technology Programs Div.	
	14:30433	K/ITP–269/P3
	14:30434	K/ITP–269/P4
	14:30625	K/ITP–237
AC05-86OR21600	**Westinghouse Materials Co. of Ohio, Cincinnati, OH (USA). Feed Materials Production Center**	
	14:30426	FMPC/Sub–014
AC05-86OR21642	**Oak Ridge National Lab., TN (USA)**	
	14:30570	ORNL/Sub–89-21242/1
	14:31296	Published article
AC06-65RL01837	**Hanford Environmental Health Foundation, Richland, WA (USA)**	
	14:32372	HEHF–54-88
AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
	14:30850	HEDL-SA–3713
	14:32915	HEDL-SA–3698
AC06-76RL01830	**Oak Ridge National Lab., TN (USA)**	
	14:31920	CONF-890692–6
	General Electric Co., Richland, WA (USA). Hanford Atomic Products Operation	
	14:30562	HW–36819
	14:32053	HW–23642
	Pacific Northwest Lab., Richland, WA (USA)	
	14:30572	PNL–6699
	14:30573	PNL–6884
	14:30894	PNL–6877
	14:31036	DOE/BP/13795–20
	14:31075	PNL–6849
	14:31224	PNL-SA–15956
	14:31966	PNL–6815
	14:31967	PNL–6824
	14:31968	PNL–6885
	14:31986	PNL–6800-Pt.3
	14:32001	PNL–6862
	14:32046	PNL–6883
	14:32390	PNL–6450-18-HEDR
	14:32391	PNL–6450-19-HEDR
	14:32392	PNL–6866
	14:32393	PNL-SA–16186
	14:32927	PNL-SA–16869
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications	
	14:30909	NUREG/CR–5351
	14:32376	NUREG/CR–5353
	14:31403	Published article
	14:31452	CONF-871038–
	14:31460	Published article
	14:31542	Published article
AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (USA)**	
	14:30530	DOE/RL–88-30-Vol.1
	14:30531	DOE/RL–88-30-Vol.2

Contract No.	Abstract No.	Report No.
	14:30614	WHC-EP-0182-12
	14:30615	WHC-EP-0195
	14:30926	WHC-SA-0204
AC07-76ID01570	EG and G Idaho, Inc., Idaho Falls, ID (USA)	
	14:30540	EGG-M-88480
	14:31110	EGG-M-88355
	14:31195	EGG-M-88231
	14:32968	EGG-M-89013
AC07-86ID12584	Stieff Research and Development Co., Inc., Kensington, MD (USA)	
	14:31064	DOE/ID/12584-43
	UNC Geotech, Grand Junction, CO (USA)	
	14:30627	DOE/ID/12584-39
	14:30705	DOE/ID/12584-29
	14:31063	DOE/ID/12584-38
AC08-83NV10282	EG and G Energy Measurements, Inc., Las Vegas, NV (USA)	
	14:31984	NVO-314
AC08-84NV10322	Fenix and Scisson, Inc., Tulsa, OK (USA)	
	14:30527	DOE/NV/10322-25
AC08-85NV10384	Nevada Univ., Las Vegas, NV (USA). Desert Research Inst.	
	14:31982	DOE/NV/10384-32
AC09-76SR00001	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
	14:30537	DPST-87-474
	14:30538	DPST-87-636
	14:30539	DPST-89-319
	14:31194	DP-MS-88-213
	14:32033	DPST-89-359
	14:32052	DPST-88-324-Rev.1
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
	14:30441	DP-MS-88-218
	14:30536	DP-MS-89-11
	14:30875	DP-MS-88-235
	14:32429	DP-MS-88-251
	Savannah River Lab., Aiken, SC (USA)	
	14:30900	DP-MS-89-5
	14:31654	DP-MS-89-4
	Westinghouse Savannah River Co., Aiken, SC (USA)	
	14:30616	WSRC-RP-89-12
AC09-89SR18035	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
	14:30441	DP-MS-88-218
	Westinghouse Savannah River Co., Aiken, SC (USA)	
	14:30616	WSRC-RP-89-12
AC21-82MC24261	Giner, Inc., Waltham, MA (USA)	
	14:31043	DOE/MC/24261-2672
AC21-85LC11062	Western Research Inst., Laramie, WY (USA)	
	14:30420	DOE/LC/11062-2660
AC21-86MC23087	SRI International, Menlo Park, CA (USA)	
	14:30249	DOE/MC/23087-2667
AC21-86MC23126	Research Triangle Inst., Research Triangle Park, NC (USA)	
	14:30250	DOE/MC/23126-2644
AC21-86MC23167	Westinghouse Electric Corp., Orlando, FL (USA). Power Systems Div.	
	14:30793	DOE/MC/23167-2678-Vol.2
AC21-87MC24267	North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center	
	14:30251	DOE/MC/24267-2664
AC22-84PC70018	Conoco, Inc., Library, PA (USA). Coal Research Div.	
	14:30246	CONF-860911-33
	14:30252	DOE/PC/70018-22
	14:30253	DOE/PC/70018-27
	Consolidation Coal Co., Library, PA (USA). Research and Development Dept.	
	14:30254	DOE/PC/70018-37
	14:30255	DOE/PC/70018-40
	14:30256	DOE/PC/70018-59
	14:30257	DOE/PC/70018-60
	14:30258	DOE/PC/70018-62
	14:30259	DOE/PC/70018-65
AC22-85PC81012	Dravo Lime Co., Pittsburgh, PA (USA)	
	14:30803	DOE/PC/81012-T1-Pt.2
AC22-85PC81201	Institute of Gas Technology, Chicago, IL (USA)	
	14:30262	DOE/PC/81201-T10
AC22-85PC81582	Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering	
	14:30273	DOE/PC/81582-T1
AC22-86PC91024	Denver Univ., CO (USA). Dept. of Engineering	
	14:30804	DOE/PC/91024-T10
AC22-87PC79818	UOP, Inc., Des Plaines, IL (USA)	
	14:30261	DOE/PC/79818-T1
	14:31399	Published article
AC22-88PC88874	Acurex Corp., Research Triangle Park, NC (USA). Environmental Systems Div.	
	14:30274	DOE/PC/88874-T3
AC22-88PC88883	Battelle Memorial Inst., Columbus, OH (USA)	
	14:30239	DOE/PC/88883-T2
AC79-86BP60288	ADM Associates, Inc., Sacramento, CA (USA)	
	14:31059	DOE/BP/60288-2-Vol.1
AC79-88BP39166	Northwest Economic Associates, Vancouver, WA (USA)	
	14:31108	DOE/BP/39166-3
	USDOE Bonneville Power Administration, Portland, OR (USA)	
	14:31107	DOE/BP/39166-2
AI03-79DP40092	Stanford Univ., CA (USA). W.W. Hansen Labs. of Physics	
	14:32926	NRL-MR-6453
AI21-83MC20422	Geological Survey, Denver, CO (USA)	
	14:30314	DOE/MC/20422-2677
AI79-83BP13795	Pacific Northwest Lab., Richland, WA (USA)	
	14:31036	DOE/BP/13795-20
AI79-85BP22493	USDOE Bonneville Power Administration, Portland, OR (USA). Div. of Fish and Wildlife	
	14:30679	DOE/BP/22493-4
AM06-70RL02225	Pacific Northwest Lab., Richland, WA (USA)	
	14:32393	PNL-SA-16186
	14:32525	Published article
	14:32564	CONF-880862-
	14:31398	Published article
	14:31401	Published article
FC09-87SR15191	South Carolina Wildlife and Marine Resources Dept., Columbia, SC (USA)	
	14:32027	DOE/SR/15191-2
FC21-84MC21136	New Mexico Inst. of Mining and Technology, Socorro, NM (USA). New Mexico Petroleum Recovery Research Center	
	14:30291	DOE/MC/21136-20

Contract No.	Abstract No.	Report No.
FC21-86MC11076	Western Research Inst., Laramie, WY (USA)	
	14:30369	DOE/MC/11076–2687
	14:30370	DOE/MC/11076–2690
	14:30391	DOE/MC/11076–2684
	14:30392	DOE/MC/11076–2688
FC22-83FE60149	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
	14:30292	NIPER–385
	14:30293	NIPER–390
	14:30310	NIPER–264
	14:30311	NIPER–319
	14:30312	NIPER–323
	14:30313	NIPER–395
FC22-88PC88861	Southern Illinois Univ., Carbondale, IL (USA)	
	14:30650	DOE/PC/88861–T16
FC22-89PC89904	Southern Illinois Univ., Carbondale, IL (USA). Coal Extraction and Utilization Research Center	
	14:30240	DOE/PC/89904–T2
FG01-84NE34122	Studsvik Energiteknik AB, Nykoeping (Sweden)	
	14:30826	STUDSVIK-STSRX–1
	14:30827	STUDSVIK-STSRX–2
	14:30828	STUDSVIK-STSRX–3
	14:30830	STUDSVIK-STSRX–7
	14:30831	STUDSVIK-STSRX–11
	14:30832	STUDSVIK-STSRX–12
	14:30833	STUDSVIK-STSRX–13
	14:30834	STUDSVIK-STSRX–15
	14:30835	STUDSVIK-STSRX–16
	14:30843	STUDSVIK-STSRX–10-Rev.
	14:30844	STUDSVIK-STSRX–14
	14:30873	STUDSVIK-STSRX–9
	14:30829	STUDSVIK-STSRX–4
	14:30836	STUDSVIK-STSRX–17
FG01-86CE63522	Iowa Natural Resources Council, Des Moines, IA (USA)	
	14:31060	DOE/CE/63522–T1
FG01-87CE15323	Lehigh Univ., Bethlehem, PA (USA)	
	14:31190	DOE/CE/15323–T5
FG01-88CE26561	TECOGEN, Inc., Waltham, MA (USA)	
	14:31137	DOE/CE/26561–T1
FG02-84ER13183	Wisconsin Univ., Madison, WI (USA). Dept. of Chemical Engineering	
	14:31276	DOE/ER/13183–3
	14:31459	Published article
	14:31509	Published article
	14:31520	Published article
	14:31542	Published article
	14:31554	Published article
	14:31514	Published article
FG02-84ER60263	Pennsylvania State Univ., University Park, PA (USA)	
	14:32025	CONF-851069–1
	14:31564	Published article
FG02-85ER40235	Illinois Inst. of Tech., Chicago, IL (USA)	
	14:32584	DOE/ER/40235–T5
FG02-85ER45211	Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science and Engineering	
	14:31191	DOE/ER/45211–13
FG02-85ER53207	Colorado Univ., Boulder, CO (USA). Dept. of Astrophysical, Planetary, and Atmospheric Sciences	
	14:32865	DOE/ER/53207–4
FG02-86ER13526	Wisconsin Univ., Madison, WI (USA). Dept. of Botany	
	14:32172	DOE/ER/13526–1
FG02-86ER13569	Rochester Univ., NY (USA). Dept. of Chemistry	
	14:31466	DOE/ER/13569–3
	14:31517	Published article
FG02-86ER13599	Michigan Univ., Ann Arbor, MI (USA). Coll. of Engineering	
	14:31319	DOE/ER/13599–T1
FG02-86ER13612	Lehigh Univ., Bethlehem, PA (USA). Zettlemoyer Center for Surface Studies	
	14:31182	CONF-880602–5
	14:31467	DOE/ER/13612–1
FG02-86ER45255	Michigan Technological Univ., Houghton, MI (USA). Dept. of Metallurgical Engineering	
	14:31192	DOE/ER/45255–3
FG02-86ER45269	Lehigh Univ., Bethlehem, PA (USA). Dept. of Materials Science and Engineering	
	14:31470	DOE/ER/45269–3
	14:32201	Published article
	14:32202	Published article
	14:31410	Published article
FG02-87ER13717	Wisconsin Univ., Madison, WI (USA)	
	14:30704	DOE/ER/13717–1
FG02-87ER13729	Michigan State Univ., East Lansing, MI (USA)	
	14:32173	DOE/ER/13729–1
	14:31506	Published article
FG02-87ER25027	Argonne National Lab., IL (USA)	
	14:31273	CONF-8905105–2
FG02-87ER45298	Cornell Univ., Ithaca, NY (USA). Dept. of Chemistry	
	14:31471	DOE/ER/45298–2
FG02-87ER45310	Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Materials Science and Engineering	
	14:32786	DOE/ER/45310–18
FG02-87ER45311	Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering	
	14:31193	DOE/ER/45311–2
FG02-87ER45317	City Coll., New York, NY (USA). Dept. of Physics	
	14:31318	CONF-890435–3
FG02-87ER53252	Pennsylvania State Univ., University Park, PA (USA)	
	14:32866	DOE/ER/53252–13
FG02-87ER60546	Illinois Univ., Urbana, IL (USA). Dept. of Nuclear Engineering	
	14:31061	DOE/ER/60546–4
FG02-87ER60551	Cold Spring Harbor Lab. of Quantitative Biology, ME (USA)	
	14:32077	CONF-8704370–
	14:31461	Published article
FG02-88CH10381	National Consumer Law Center, Washington, DC (USA)	
	14:30306	DOE/CH/10381–3
FG02-88ER13912	Harvard Univ., Cambridge, MA (USA)	
	14:31468	DOE/ER/13912–1
FG02-88ER13933	Pittsburgh Univ., PA (USA). Dept. of Chemistry	
	14:31469	DOE/ER/13933–1
	14:32659	Published article
FG02-88ER40465	Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center	
	14:32864	DOE/ER/40465–T1
FG02-88ER60664	Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)	
	14:31062	DOE/ER/60664–1
	14:31556	Published article
	14:31462	Published article
	14:31710	Published article
	14:32659	Published article

Contract No.	Abstract No.	Report No.
FG05-80ET53088	**Texas Univ., Austin, TX (USA). Inst. for Fusion Studies**	
	14:32703	DOE/ET/53088–369
	14:32867	DOE/ET/53088–372
FG05-83OR21389	**CONEG Policy Research Center, Inc., Washington, DC (USA)**	
	14:30672	DOE/OR/21389–16
	Energy Systems Research Group, Inc., Boston, MA (USA)	
	14:31039	DOE/OR/21389–17
	14:31405	Published article
	14:32606	Published article
FG05-84ER45063	**Southwest Research Inst., San Antonio, TX (USA)**	
	14:31277	DOE/ER/45063–4
	14:31585	Published article
FG05-85ER60336	**California Univ., San Diego, La Jolla, CA (USA). Inst. of Marine Resources**	
	14:32438	DOE/ER/60336–5
	14:31546	Published article
FG05-86ER60466	**American Statistical Association, Alexandria, VA (USA)**	
	14:32370	CONF-8707194–Summs.
FG05-87ER13745	**Georgia Inst. of Tech., Atlanta, GA (USA)**	
	14:32491	DOE/ER/13745–2
FG05-87ER13782	**Maryland Univ., College Park, MD (USA). Dept. of Mechanical Engineering**	
	14:31595	DOE/ER/13782–3
	14:32559	CONF-880862–
	14:32564	CONF-880862–
FG05-87ER60517	**Florida State Univ., Tallahassee, FL (USA). Inst. of Molecular Biophysics**	
	14:31472	DOE/ER/60517–3
FG05-87ER60558	**American Statistical Association, Washington, DC (USA)**	
	14:32369	CONF-8607379–Summs.
	14:32659	Published article
FG05-88ER40467	**Alabama Univ., Huntsville, AL (USA)**	
	14:32680	DOE/ER/40467–2
FG05-88ER45359	**North Carolina State Univ., Raleigh, NC (USA)**	
	14:31278	DOE/ER/45359–1
FG06-80ET34033	**Risoe National Lab., Roskilde (Denmark)**	
	14:30871	RISO-FGP-R–14-Rev.
	14:30872	RISO-FGP-R–16
FG06-85ER40224	**Oregon Univ., Eugene, OR (USA)**	
	14:32583	DOE/ER/40224–64
FG08-85NV10461	**Nevada Nuclear Waste Project Office, Carson City, NV (USA)**	
	14:30528	DOE/NV/10461–T1-Vol.1
FG09-84ER60255	**South Carolina Univ., Columbia, SC (USA). Dept. of Biological Sciences**	
	14:31924	DOE/ER/60255–5
	14:31534	Published article
FG09-87SR18001	**Voorhees Coll., Denmark, SC (USA)**	
	14:30275	DOE/SR/18001–2
	14:31511	Published article
FG22-84PC70809	**University of Southern California, Los Angeles, CA (USA)**	
	14:30260	DOE/PC/70809–T15
	14:31516	Published article
FG22-85PC80522	**North Dakota Univ., Grand Forks, ND (USA). Dept. of Chemistry**	
	14:30270	DOE/PC/80522–T7
FG22-87BC14152	**Colorado School of Mines, Golden, CO (USA)**	
	14:30289	DOE/BC/14152–2
FG22-88PC88930	**State Univ. of New York, Binghamton, NY (USA). Dept. of Chemistry**	
	14:30263	DOE/PC/88930–T2
FG22-89BC14304	**Underground Injection Practices Council, Oklahoma City, OK (USA)**	
	14:30286	DOE/BC/14304–T1
	14:30431	CONF-871038–
	14:31242	Published article
	14:31295	Published article
	14:31300	Published article
	14:31302	Published article
	14:31310	Published article
	14:31349	Published article
	14:31415	Published article
	14:31479	Published article
	14:31481	Published article
	14:31548	Published article
	14:31565	Published article
	14:31573	Published article
	14:31659	Published article
	14:32521	Published article
	14:32575	Published article
	14:32644	Published article
	14:32668	Published article
	14:32755	Published article
	14:32813	Published article
W-31109-ENG-38	**Argonne National Lab., Idaho Falls, ID (USA)**	
	14:30857	CONF-890406–17
	Argonne National Lab., IL (USA)	
	14:30271	CONF-8904197–2
	14:30281	CONF-890402–6
	14:30321	GRI–88/0319
	14:30524	CONF-890488–8
	14:30631	CONF-890406–19
	14:30646	CONF-8810182–28
	14:30654	CONF-890177–2
	14:30849	CONF-890425–3
	14:30961	ANL–9012378
	14:31136	CONF-890624–1
	14:31157	CONF-890108–1
	14:31169	CONF-890124–4
	14:31185	CONF-881155–74
	14:31186	CONF-890165–3
	14:31187	CONF-890630–1
	14:31188	CONF-8811147–3
	14:31269	CONF-890306–4
	14:31270	CONF-890426–11
	14:31271	CONF-890426–12
	14:31272	CONF-8810290–2
	14:31273	CONF-8905105–2
	14:31274	CONF-8905118–8
	14:31275	CONF-8905118–9
	14:31316	CONF-881174–4
	14:31593	CONF-890309–1
	14:31692	CONF-890335–170
	14:31693	CONF-890335–172
	14:31694	CONF-8810182–30
	14:31732	CONF-8709217–5
	14:31733	CONF-8905121–2
	14:31785	CONF-890335–171
	14:31800	ANL-HEP-CP–89-12
	14:31801	ANL-HEP-CP–89-33
	14:31863	CONF-881079–2
	14:31905	CONF-870430–17
	14:31918	CONF-881245–2
	14:31919	CONF-890521–10
	14:32026	CONF-890207–30
	14:32371	CONF-8904203–2
	14:32489	CONF-890517–1
	14:32546	CONF-8809223–7
	14:32696	CONF-890406–18
	14:32898	CONF-881031–70
	14:32981	ANL/TM–466
	14:32984	CONF-890662–1

Contract No.	Abstract No.	Report No.
	14:32986	CONF-8904210–1
	14:32987	CONF-8904219–1
	Argonne National Lab., IL (USA). High Energy Physics Div.	
	14:32819	ANL-HEP-CP–88-84
	Argonne National Lab., IL (USA). Energy and Environmental Systems Div.	
	14:30970	ANL/EES-TM–371
	Los Alamos National Lab., NM (USA)	
	14:32459	LA-UR–89-1760
	14:32835	LA-UR–89-1604
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Reactor Accident Analysis	
	14:30877	NUREG/CR–5274
	Argonne National Lab., Washington, DC (USA)	
	14:31922	CONF-890692–11
W-7405-ENG-36	**Electric Power Research Inst., Palo Alto, CA (USA)**	
	14:30811	EPRI-ER–6399
	Los Alamos National Lab., NM (USA)	
	14:30988	LA–11561-MS
	14:31068	LA-UR–89-1059
	14:31161	LA–11560-MS
	14:31215	LA–11543-C
	14:31216	LA–11588-MS
	14:31332	LA-UR–89-1722
	14:31333	LA-UR–89-1852
	14:31393	LA-UR–89-1471
	14:31473	LA-UR–89-1684
	14:31598	LA-UR–89-1685
	14:31628	LA-UR–89-1838
	14:31696	LA-UR–89-1599
	14:31720	LA-UR–89-1550
	14:31752	LA-UR–89-1497
	14:31753	LA-UR–89-1571
	14:31754	LA-UR–89-1572
	14:31755	LA-UR–89-1573
	14:31756	LA-UR–89-1574
	14:31757	LA-UR–89-1600
	14:31788	LA-UR–89-1575
	14:31823	LA–11596-MS
	14:31824	LA–11612-MS
	14:31893	LA–10773-Add.
	14:31894	LA-UR–88-4130
	14:31899	LA–11419-MS
	14:31900	LA–11538-MS
	14:32036	LA-UR–89-1503
	14:32174	LA-UR–89-1788
	14:32176	PATENTS-US–A7155451
	14:32348	LA–11579-C
	14:32349	LA-UR–89-1207
	14:32431	LA-UR–89-1793
	14:32458	LA-UR–89-1507
	14:32505	LA–11575-T
	14:32506	LA-UR–89-1607
	14:32589	LA-UR–89-1576
	14:32737	LA-UR–89-1747
	14:32738	LA-UR–89-1748
	14:32835	LA-UR–89-1604
	14:32923	LA–11519-MS
	14:33001	LA-UR–89-760
	14:33002	LA-UR–89-1511
	14:33003	LA-UR–89-1693
	14:33004	LA-UR–89-1832
	14:33025	LA–11506-PR
	14:33026	LA–11557-MS
	14:33027	LA–11573-MS
	14:31331	LA-UR–89-956
	14:33017	Published article

Contract No.	Abstract No.	Report No.
W-7405-ENG-48	**Argonne National Lab., IL (USA)**	
	14:30611	UCRL–21060-87-2
	California Univ., Los Angeles, CA (USA). Inst. of Geophysics and Planetary Physics	
	14:32463	UCRL–98769
	Colorado School of Mines, Golden, CO (USA)	
	14:30343	CONF-880589–
	14:30346	CONF-880589–
	14:30351	CONF-880589–
	Massachusetts Inst. of Tech., Cambridge, MA (USA). Research Lab. of Electronics	
	14:31634	UCRL–21203
	Lawrence Livermore National Lab., CA (USA)	
	14:30394	UCID–21594
	14:30610	UCID–21700
	14:30612	UCRL–53615-87
	14:30613	UCRL–100395
	14:30990	UCRL–53689-88
	14:31093	UCID–20717-Rev.1
	14:31094	UCRL–100878
	14:31337	UCRL–21201
	14:31586	UCID–21646
	14:31617	UCID–21733
	14:31622	UCRL–53924
	14:31623	UCRL–98804
	14:31633	UCID–21703
	14:31677	UCRL–53925
	14:31678	UCRL–100861
	14:31707	UCRL–99869
	14:31729	UCRL–99593
	14:31782	UCRL–98803
	14:31783	UCRL–100910
	14:31784	UCRL–100911
	14:31878	UCRL–100185
	14:31879	UCRL–100189
	14:31897	UCRL–100064
	14:31910	UCID–21633
	14:31912	UCRL–100817
	14:31971	UCID–21631
	14:31972	UCRL–99883
	14:31973	UCRL–99926
	14:31974	UCRL–99927
	14:31975	UCRL–99928
	14:31976	UCRL–100721-Rev.1
	14:32423	UCRL–98720
	14:32435	UCRL–99662
	14:32464	UCRL–101121
	14:32492	DOE/FTR–9012477
	14:32508	UCRL–52000-89-2-3
	14:32529	UCRL–100879
	14:32530	UCRL–100880
	14:32681	UCRL–100825
	14:32740	UCRL–100998
	14:32754	UCRL–99499
	14:32802	UCRL–100168
	14:32839	UCRL–97838
	14:32840	UCRL–100192
	14:32841	UCRL–100883
	14:32842	UCRL–101001
	14:32886	UCRL–100577
	14:32932	UCID–21681
	14:32973	UCRL–100655
	14:33011	UCID–21622
	14:33012	UCRL–100156
	14:33013	UCRL–101060
	14:33024	UCID–21677
	14:33030	UCID–21701
	14:33031	UCRL–100789

Contract No.	Abstract No.	Report No.
	14:31618	UCRL–21192
	14:31619	UCRL–21192
	14:31620	UCRL–21192
	14:31621	UCRL–21192
	14:31911	UCRL–21003
	Science Applications International Corp., McLean, VA (USA)	
	14:31172	UCRL–21205
	Defense Advanced Research Projects Agency, Arlington, VA (USA)	
	14:31904	UCRL–21086-Vol.1
	14:31312	Published article
	14:31356	Published article
	14:31532	Published article
	14:32511	Published article
	14:32676	Published article
	14:32682	Published article
	14:32845	Published article
	14:32852	Published article
	14:32894	Published article
	14:33019	Published article
	14:31254	Published article
	14:31261	Published article
	14:31400	Published article
	14:31404	Published article
	14:31407	Published article
	14:31458	Published article
	14:31505	Published article
	14:31518	Published article
	14:31531	Published article
	14:31536	Published article
	14:31541	Published article
	14:31881	Published article
	14:32402	Published article
	14:32806	Published article
	14:32817	Published article

Report Number Index

The report number index consists of the alphanumeric identifiers assigned to report literature as well as patent and conference literature cited in this publication. Entries provide the abstract number; the source(s) of availability of the document; the GPO file prefix for GPO depository library documents; the order number for OSTI and NTIS report ordering purposes; and, if the document was distributed under the DOE distribution program, the category number is shown for paper copy (PC), microfiche (MF), or no distribution (ND). These categories are included to assist DOE librarians in responding to requests for reports in their collections. The index also lists secondary numbers, with the corresponding abstract numbers and cross-references to other identifying numbers.

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
AAC-TR–					
18161/83-VOL-1-SAN	14:31170	*See* AD-A–204286/9/XAB			
ACERR–					
1989	14:30371	Alberta Energy and Natural Resources, Information Centre, 9920-108 St., Edmonton, AB, Canada T5K 2M4; $N/C.			ND-000
ACIESP–					
60(v.3)	14:32472	NTIS (US Sales Only), PC A17/MF A01 - OSTI; INIS		DE89612371/JAW	MF-000
ACNP–					
9012652	14:32363	American College of Nuclear Physicians, 1101 Connecticut Avenue, N.W., Suite 700, Washington, DC 20036			ND-000
ACR/CR–					
YCLQ-5	14:30241	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
YCLQ-7	14:30242	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
YCLQ-10	14:30269	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
YCLQ-18	14:30243	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
YCPY-5	14:30244	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
AD-A–					
204040/0/XAB	14:32481	NTIS, PC A02/MF A01			ND-00
204042/6/XAB	14:32482	NTIS, PC A02/MF A01			ND-00
204043/4/XAB	14:32483	NTIS, PC A02/MF A01			ND-00
204060/8/XAB	14:31005	NTIS, PC A09/MF A01			ND-00
204073/1/XAB	14:30298	NTIS, PC A10/MF A01			ND-00
204100/2/XAB	14:31651	NTIS, PC A03/MF A01			ND-00
204126/7/XAB	14:32974	NTIS, PC A02/MF A01			ND-00
204154/9/XAB	14:31155	NTIS, PC A03/MF A01			ND-00
204161/4/XAB	14:31579	NTIS, PC A03/MF A01			ND-00
204162/2/XAB	14:31175	NTIS, PC A05/MF A01			ND-00
204164/8/XAB	14:32975	NTIS, PC A03/MF A01			ND-00
204186/1/XAB	14:31168	NTIS, PC A03/MF A01			ND-00
204187/9/XAB	14:31626	NTIS, PC A03/MF A01			ND-00
204202/6/XAB	14:32746	NTIS, PC A03/MF A01			ND-00
204225/7/XAB	14:31627	NTIS, PC A04/MF A01			ND-00
204233/1/XAB	14:31314	NTIS, PC A03/MF A01			ND-00
204237/2/XAB	14:31913	NTIS, PC A03/MF A01			ND-00
204258/8/XAB	14:32976	NTIS, PC A02/MF A01			ND-00
204285/1/XAB	14:31711	NTIS, PC A04/MF A01			ND-00
204286/9/XAB	14:31170	NTIS, PC A04/MF A01			ND-00

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
204295/0/XAB	14:31568	NTIS, PC A03/MF A01			ND-00
204364/4/XAB	14:31652	NTIS, PC A07/MF A01			ND-00
204376/8/XAB	14:32477	NTIS, PC A03/MF A01			ND-00
204377/6/XAB	14:32441	NTIS, PC A02/MF A01			ND-00
204382/6/XAB	14:32029	NTIS, PC A07/MF A01			ND-00
204383/4/XAB	14:32030	NTIS, PC A15/MF A01			ND-00
204384/2/XAB	14:32031	NTIS, PC A12/MF A01			ND-00
204433/7/XAB	14:32484	NTIS, PC A02/MF A01			ND-00
204434/5/XAB	14:32485	NTIS, PC A02/MF A01			ND-00
204435/2/XAB	14:32486	NTIS, PC A02/MF A01			ND-00
204460/0/XAB	14:31891	NTIS, PC A12/MF A01			ND-00
204463/4/XAB	14:32977	NTIS, PC A04/MF A01			ND-00
204474/1/XAB	14:32442	NTIS, PC A04/MF A01			ND-00
204475/8/XAB	14:32487	NTIS, PC A02/MF A01			ND-00
204481/6/XAB	14:31898	NTIS, PC A02/MF A01			ND-00
204505/2/XAB	14:31988	NTIS, PC A06/MF A01			ND-00
204510/2/XAB	14:31176	NTIS, PC A02/MF A01			ND-00
204522/7/XAB	14:31156	NTIS, PC A03/MF A01			ND-00
204556/5/XAB	14:31266	NTIS, PC A02/MF A01			ND-00
204575/5/XAB	14:31267	NTIS, PC A02/MF A01			ND-00
204577/1/XAB	14:32978	NTIS, PC A02/MF A01			ND-00
204581/3/XAB	14:32364	NTIS, PC A03/MF A01			ND-00
204597/9/XAB	14:32365	NTIS, PC A03/MF A01			ND-00
204598/7/XAB	14:32366	NTIS, PC A03/MF A01			ND-00
204599/5/XAB	14:32443	NTIS, PC A03/MF A01			ND-00
204609/2/XAB	14:32979	NTIS, PC A02/MF A01			ND-00
204611/8/XAB	14:32980	NTIS, PC A02/MF A01			ND-00
204620/9/XAB	14:32032	NTIS, PC A08/MF A01			ND-00
AE/SESR–					
1989	14:31054	Dept. of Energy, Information Centre, Petroleum Plaza Tower, 9915-108 St., Edmonton, AB, Canada T5K 2C9; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
AERE-M–					
3679	14:32782	H.M. Stationery Office, London, price Pound 10.00			ND-000
3708	14:31861	H.M. Stationery Office, London, price Pound 8.00			ND-000
AERE-R–					
12515	14:32071	*See* NSS/R–132			
12863	14:31382	H.M. Stationery Office, London, price Pound 8.00			ND-000
13215	14:31587	H.M. Stationery Office, London, price Pound 8.00			ND-000
13349	14:31315	H.M. Stationery Office, London, price Pound 12.00			ND-000
AFME–					
FR.17	14:31106	NTIS (US Sales Only), PC A22/MF A01		DE89764081/JAW	MF-000
AFRRI-SR–					
88-7	14:32364	*See* AD-A–204581/3/XAB			
AIL–					
401U463	14:30927	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
AMXTH-TE-CR–					
88272	14:31901	*See* ORNL/TM–10921			
ANL–					
88-47	14:30877	*See* NUREG/CR–5274			
9012378	14:30961	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012378/JAW	MF-331
ANL-HEP-CP–					
88-84	14:32819	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013273/JAW	MF-414
89-12	14:31800	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013653/JAW	MF-414
89-33	14:31801	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013276/JAW	MF-414
ANL/EES-TM–					
371	14:30970	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012930/JAW	MF-350
ANL/TM–					
466	14:32981	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012245/JAW	MF-400
ANSTO/E–					
663	14:30620	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89616599/JAW	MF-000
674	14:31990	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616231/JAW	MF-000
676	14:31177	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616080/JAW	MF-000
677	14:30621	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616596/JAW	MF-000
679	14:30643	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616941/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ANSTO/E–					
680	14:32050	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616248/JAW	MF-000
ANU-P–					
1000	14:32679	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615835/JAW	MF-000
1002	14:32783	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615449/JAW	MF-000
1007	14:32662	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615826/JAW	MF-000
965	14:31178	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89616019/JAW	MF-000
969	14:32674	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615833/JAW	MF-000
978	14:31802	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89617333/JAW	MF-000
979	14:31862	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89617385/JAW	MF-000
981	14:32661	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615827/JAW	MF-000
983	14:32677	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615836/JAW	MF-000
984	14:32694	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615813/JAW	MF-000
990	14:32678	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89615837/JAW	MF-000
992	14:31691	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89616996/JAW	MF-000
995	14:32695	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615774/JAW	MF-000
999	14:32488	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615411/JAW	MF-000
ARC–					
1989	14:30372	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
ATLSS–					
89-08	14:31190	*See* DOE/CE/15323–T5			
AUC-IBT-R–					
8806	14:31686	NTIS (US Sales Only), PC A02/MF A01;1		DE89776139/JAW	MF-000
BARC–					
1420	14:30878	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89616243/JAW	MF-000
1424	14:31653	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89616963/JAW	MF-000
1427	14:32747	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89612741/JAW	MF-000
1429	14:32418	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89613512/JAW	MF-000
1437	14:31383	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613058/JAW	MF-000
BCH–					
1988	14:31006	B.C. Hydro, 970 Burrard St., Vancouver, BC, Canada V6Z 1Y3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
BCH/RLM–					
8810	14:30678	British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
BCMEP–					
8801	14:31914	British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8807	14:31134	British Columbia. Ministry of Environment and Parks, Parliament Bldgs., Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8808	14:31915	British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
BCPC–					
1988	14:30317	British Columbia Petroleum Corporation, 1199 West Hastings St, 6th Floor, Vancouver, BC, Canada V6E 3T5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
BEST–					
631U574	14:31055	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
BFR-R–					
92-1988	14:31135	NTIS (US Sales Only), PC A03/MF A01;1		DE89766935/JAW	MF-000
BINE–					
0005	14:31805	*See* CNIC–00130			
BISI–					
25971	14:30295	British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			ND-000
BNL–					
34518	14:32542	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013211/JAW	MF-414
41390	14:30245	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012223/JAW	MF-102
42275	14:31588	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012226/JAW	MF-406
42277	14:31916	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013212/JAW	MF-402
42334	14:30985	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012554/JAW	MF-400
42416	14:32367	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010250/JAW	MF-407
42502	14:31056	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012218/JAW	MF-000
42535	14:32545	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011877/JAW	MF-414
42537	14:32580	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012580/JAW	MF-414
42564	14:30454	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012228/JAW	MF-512
42663	14:30766	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011902/JAW	MF-250
42683	14:31803	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012672/JAW	MF-414
42688	14:31804	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012673/JAW	MF-414
42715	14:32581	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012674/JAW	MF-410
52165	14:30986	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012793/JAW	PC-400;STD-500
BNL-NUREG–					
42259	14:30895	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012546/JAW	MF-000
42595	14:30455	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012545/JAW	MF-000
52166	14:30824	*See* NUREG/CR–5244			
CANMET–					
5078-01	14:31681	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8711	14:31917	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
88-60	14:31680	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
W13GEN-14	14:30416	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CBPF-NF–					
041/88	14:32412	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613060/JAW	MF-000
CCHEN–					
1	14:32756	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89616685/JAW	MF-000
CCREM–					
8809	14:31994	Canadian Council of Resource and Environment Ministers, 4905 Dufferin St., Downsview, ON, Canada M3H 5T4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CE–					
02414	14:30279	*See* CMRC–82/56-BG			
02429	14:30269	*See* ACR/CR–YCLQ-10			
02433	14:30241	*See* ACR/CR–YCLQ-5			
02434	14:30242	*See* ACR/CR–YCLQ-7			
02436	14:31685	*See* CMRC–82/64-BG			
02438	14:30372	*See* ARC–1989			
02441	14:30243	*See* ACR/CR–YCLQ-18			
02442	14:30244	*See* ACR/CR–YCPY-5			
02557	14:31070	*See* NRC/BR–859			
02558	14:33020	*See* NRC/BR–387			
02569	14:31040	*See* EMR/RE–8702			
02570	14:31154	*See* EMR/TE–88-7			
02580	14:30676	*See* OME–1988			
02582	14:31118	*See* OAF/AEG–88-5103			
02583	14:31117	*See* OAF/AEG–88-3301			
02584	14:30318	*See* ERCB–E87128/87-C			
02585	14:30315	*See* ERCB–ST88-47			
02586	14:31065	*See* EI–8311			
02592	14:31133	*See* VI–422USOA			
02594	14:32404	*See* OH/RD–118-D-393			
02595	14:31130	*See* SHA–527U537			
02596	14:31141	*See* MEC–628USOA			
02597	14:30814	*See* OH/RD–072T223			
02598	14:30699	*See* OH/RD–513G543			
02600	14:30812	*See* IREQ–146T328			
02602	14:30796	*See* OH/RD–004G213			
02603	14:30802	*See* TTS–711G624			
02604	14:30817	*See* SC–653U604			
02606	14:32408	*See* CEA/RD–ST272SR			
02607	14:30927	*See* AIL–401U463			
02608	14:30816	*See* ORF/T–228U359			
02611	14:31132	*See* SU/EE–309U403			
02616	14:31140	*See* LPI–520U527			
02617	14:31055	*See* BEST–631U574			
02618	14:30815	*See* OH/RD–177T510			
02619	14:31671	*See* OH/RD–419G485			
02653	14:30371	*See* ACERR–1989			
CEA-CONF–					
9219	14:32784	NTIS (US Sales Only), PC A03/MF A01		DE89776433/JAW	MF-000
9415	14:31384	NTIS (US Sales Only), PC A03/MF A01		DE89760705/JAW	MF-000
9436	14:30644	NTIS (US Sales Only), PC A02/MF A01		DE89760706/JAW	MF-000
9437	14:30645	NTIS (US Sales Only), PC A02/MF A01		DE89760707/JAW	MF-000
9628	14:31731	NTIS (US Sales Only), PC A02/MF A01		DE89776486/JAW	MF-000
9635	14:31179	NTIS (US Sales Only), PC A02/MF A01		DE89776487/JAW	MF-000
9638	14:32860	NTIS (US Sales Only), PC A02/MF A01		DE89770511/JAW	MF-000
9639	14:32861	NTIS (US Sales Only), PC A03/MF A01		DE89770510/JAW	MF-000
9672	14:31268	NTIS (US Sales Only), PC A02/MF A01		DE89760613/JAW	MF-000
9694	14:32982	NTIS (US Sales Only), PC A02/MF A01		DE89760576/JAW	MF-000
9695	14:30856	NTIS (US Sales Only), PC A02/MF A01		DE89760575/JAW	MF-000
9702	14:31180	NTIS (US Sales Only), PC A03/MF A01		DE89760690/JAW	MF-000
9717	14:30863	NTIS (US Sales Only), PC A03/MF A01		DE89770509/JAW	MF-000
9719	14:30847	NTIS (US Sales Only), PC A03/MF A01		DE89770506/JAW	MF-000
9758	14:31181	NTIS (US Sales Only), PC A02/MF A01		DE89770536/JAW	MF-000
9759	14:30848	NTIS (US Sales Only), PC A03/MF A01		DE89770508/JAW	MF-000
9760	14:30437	NTIS (US Sales Only), PC A03/MF A01		DE89770502/JAW	MF-000
9761	14:31589	NTIS (US Sales Only), PC A03/MF A01		DE89770503/JAW	MF-000
CEA-DAS–					
560	14:31981	NTIS (US Sales Only), PC A02/MF A01		DE89776468/JAW	MF-000
CEA/RD–					
ST272SR	14:32408	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
CEBAF-PR–					
89-010-Rev.	14:31734	*See* DOE/ER/40150–68-Rev.			
CMRC–					
82/56-BG	14:30279	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
82/64-BG	14:31685	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
CMS-TSR–					
89-4	14:31651	*See* AD-A–204100/2/XAB			
CNEN-NE–					
5-03	14:32757	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616630/JAW	MF-000
CNIC–					
00057	14:31465	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614723/JAW	MF-000
00088	14:30896	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614329/JAW	MF-000
00130	14:31805	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614619/JAW	MF-000
00160	14:32897	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89612438/JAW	MF-000
00171	14:31806	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617353/JAW	MF-000
00175	14:32006	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613464/JAW	MF-000
COGLA–					
8809	14:30302	British Columbia Legislative Library, Government Documents Division, Parliament Buildings, Victoria, BC, Canada V8V 1X4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CONF-7206120–		(Meeting on CIB W 52: Subgroup 1; Stockholm, Sweden; 19-20 Jun 1972)			
	14:33020	*See* NRC/BR–387			
CONF-7805256–		(Conference on the use of computers for environmental engineering related to buildings; Banff, Canada; 10-12 May 1978)			
	14:31070	*See* NRC/BR–859			
CONF-8311130–		(International conference on fracture prevention in energy and transport systems; Rio de Janeiro, Brazil; 27 Nov - 2 dec 1983)			
	14:30868	*See* INIS-BR–1462			
	14:30869	*See* INIS-BR–1467			
	14:30905	*See* INIS-BR–1465			
	14:31201	*See* INIS-BR–1459			
	14:31202	*See* INIS-BR–1460			
	14:31203	*See* INIS-BR–1461			
	14:31204	*See* INIS-BR–1463			
	14:31205	*See* INIS-BR–1464			
	14:31206	*See* INIS-BR–1466			
CONF-8409109–		(Industrial temperature measurement symposium; Knoxville, Tennessee, USA; 10-12 Sep 1984)			
	14:31880	University of Tennessee at Knoxville, Department of Nuclear Engineering, Knoxville, TN 37996			
CONF-851069–		(Wetlands and water management on mined lands conference; University Park, Pennsylvania, USA; 23-24 Oct 1985)			
1	14:32025	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012392/JAW	MF-403
CONF-8603261–		(Workshop on advanced high-strength materials; Clearwater Beach, Florida, USA; 12-13 Mar 1986)			
	14:30821	*See* EPRI-NP–6363			
CONF-8605274–		(51. Cold Spring Harbor symposium on quantitative biology: molecular biology of Homo sapiens; Cold Spring Harbor, New York, USA; 28 May - 4 jun 1986)			
Pt.1	14:32203	Cold Spring Harbor Lab., Box 100, Cold Spring Harbor, NY 11724			ND-408
CONF-8607379–		(Coolfont VI: 6. annual American Statistical Association (ASA) conference on radiation and health; Berkeley Springs, West Virginia, USA; 20-25 Jul 1986)			
Summs.	14:32369	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011529/JAW	MF-407
CONF-860911–		(192. American Chemical Society national meeting; Anaheim, California, USA; 7-12 Sep 1986)			
33	14:30246	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013139/JAW	MF-108
CONF-8609472–		(France - Korea - 2. joint seminar on energy conservation; Seoul, Republic of Korea; 11-12 Sep 1986)			
	14:31106	*See* AFME–FR.17			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-860969–		(4. European congress and 13. regional congress of the International Radiation Protection Association; Salzburg, Austria; 15-19 Sep 1986)			
	14:32377	*See* OEVS-Mitteilung–1988			
CONF-861109–		(2. international daylighting conference: architecture and natural light; Long Beach, California, USA; 5-7 Nov 1986)			
9	14:31091	*See* SERI/TP–254-3049			
CONF-8611214–		(16. international symposium on nuclear physics - dynamics of heavy ion collisions; Gaussig, German Democratic Republic; 10-14 Nov 1986)			
	14:32655	*See* CRN-PN–8630			
CONF-8612138–		(1. national meeting on thermal sciences; Rio de Janeiro, RJ, Brazil; 10-12 Dec 1986)			
	14:30851	*See* INIS-BR–1510			
	14:31655	*See* INIS-BR–1509			
CONF-870154–		(15. international workshop on gross properties of nuclei and nuclear excitations; Hirschegg, Austria; 12-17 Jan 1987)			
	14:32722	*See* INIS-mf–11959			
CONF-8702152–					
	14:31040	*See* EMR/RE–8702			
CONF-8702174–		(BNL neutrino workshop; Upton, New York, USA; 5-7 Feb 1987)			
	14:32836	*See* LPNHE–8701			
CONF-870422–		(89. annual meeting of the American Ceramic Society; Pittsburgh, Pennsylvania, USA; 26-30 Apr 1987)			
12	14:32915	*See* HEDL-SA–3698			
CONF-870424–		(American Nuclear Society international meeting on advances in reactor physics, mathematics and computation; Paris, France; 27-30 Apr 1987)			
	14:30874	*See* CTA-IEAv-RP–019/88			
CONF-870430–		(International conference on methods and applications of radioanalytical chemistry; Kona, Hawaii, USA; 5-10 Apr 1987)			
17	14:31905	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013625/JAW	MF-401
CONF-8704370–		(Eukaryotic transposable elements as mutagenic agents; Cold Springs Harbor, New York, USA; 21 Apr 1987)			
	14:32077	Cold Spring Harbor Laboratory, Box 100, Cold Spring Harbor, NY 11724			ND-408
CONF-8704380–		(Conveno celebrativo del 50 anniversairo Dell 'Instituto Di Acustica E commemorotivne Del Fondatore Orso Mario Corbino; Rome, Italy; 28-30 Apr 1987)			
1	14:32785	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011221/JAW	MF-410
CONF-870511–		(4. international hazardous waste symposium on environmental aspects of stabilization-solidification of hazardous and radioactive wastes; Atlanta, Georgia, USA; 3-6 May 1987)			
7	14:30454	*See* BNL–42564			
CONF-8707194–		(7. annual American Statistical Association (ASA) conference on radiation and health; Berkeley Springs, West Virginia, USA; 12-17 Jul 1987)			
Summs.	14:32370	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011528/JAW	MF-407
CONF-870905–		(6. Pacific Basin nuclear conference; Beijing, China; 7-11 Sep 1987)			
	14:31003				
CONF-870917–		(ANS/ENS international conference on fast breeder reactor systems: experience gained and path to economical power generation; Richland, Washington, USA; 13-17 Sep 1987)			
15	14:30850	*See* HEDL-SA–3713			
CONF-8709217–		(SNEAP conference; Tallahassee, Florida, USA; 27 Sep - 2 oct 1987)			
5	14:31732	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012689/JAW	MF-414
CONF-870959–		(1. international conference on neutron physics; Kiev, USSR; 21 Sep 1987)			
	14:32647	*See* INIS-SU–78			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-871038–		(5. symposium on separation science and technology for energy applications; Knoxville, Tennessee, USA; 26-29 Oct 1987)			
	14:30268				
	14:30430				
	14:30431				
	14:30443				
	14:30444				
	14:30445				
	14:30446				
	14:30447				
	14:30619				
	14:30653				
	14:31396	Marcel Dekker Journals, P.O. Box 10018, Church Street Station, New York, NY 10249			
	14:31412				
	14:31413				
	14:31414				
	14:31416				
	14:31417				
	14:31418				
	14:31419				
	14:31420				
	14:31421				
	14:31422				
	14:31423				
	14:31424				
	14:31425				
	14:31426				
	14:31427				
	14:31428				
	14:31429				
	14:31430				
	14:31431				
	14:31432				
	14:31433				
	14:31434				
	14:31435				
	14:31436				
	14:31437				
	14:31438				
	14:31439				
	14:31440				
	14:31441				
	14:31442				
	14:31443				
	14:31444				
	14:31445				
	14:31446				
	14:31447				
	14:31448				
	14:31449				
	14:31450				
	14:31451				
	14:31452				
	14:31453				
	14:31454				
	14:31455				
	14:31456				
	14:31457				
	14:31488				
	14:31489				
	14:31490				
	14:31491				
	14:31492				
	14:31493				
	14:31494				
	14:31571				
CONF-8710386–		(Workshop on mass spectrometry; Marcoule, France; 22-23 Oct 1987)			
	14:31384	*See* CEA-CONF–9415			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8711149–		(Conference on high energy radiation background in space; Sanibel Island, Florida, USA; 2-5 Nov 1987)			
4	14:32458	*See* LA-UR–89-1507			
CONF-8711304–		(The laser vs the electron beam in welding, cutting and surface treatment; Harrah's Reno, Nevada, USA; 1-3 Nov 1987)			
	14:32784	*See* CEA-CONF–9219			
CONF-880110–		(SPIE O-E Lase '88: optoelectronics and laser applications in science and engineering; Los Angeles, California, USA; 10-17 Jan 1988)			
37	14:32839	*See* UCRL–97838			
CONF-880214–		(Seminar for developing countries in Africa on food irradiation; Dakar, Senegal; 15-19 Feb 1988)			
	14:30644	*See* CEA-CONF–9436			
	14:30645	*See* CEA-CONF–9437			
CONF-880259–		(Metal forming modeling (MFM) subgroup of IMOG; Los Alamos, New Mexico, USA; 23-25 Feb 1988)			
Summ.	14:31215	*See* LA–11543-C			
CONF-8803129–		(4. workshop on laser switched power accelerators; Erice, Italy; 4-9 Mar 1988)			
4	14:31705	*See* SLAC-PUB–4894			
CONF-8803133–		(Nonneutral plasma physics; Washington, D.C., USA; 28-29 Mar 1988)			
1	14:32864	*See* DOE/ER/40465–T1			
CONF-8803210–		(Technical meeting on on-line analytical control; Cadarache, France; 10-11 Mar 1988)			
	14:30437	*See* CEA-CONF–9760			
	14:31589	*See* CEA-CONF–9761			
CONF-8804123–		(International workshop on plasma edge theory in fusion devices; Augustusburg, German Democratic Republic; 26-30 Apr 1988)			
	14:32860	*See* CEA-CONF–9638			
CONF-8804186–		(23. Zakopane school on physics; Zakopane, Poland; 16-23 Apr 1988)			
	14:32591	*See* NBI-HE–89-01			
CONF-8804199–		(Celebratory symposium on a decade of UV astronomy with the IUE satellite; Greenbelt, Maryland, USA; 12 Apr 1988)			
	14:32445	*See* ESA-SP–281			
	14:32446	*See* ESA-SP–281			
CONF-8804217–		(32. Brazilian congress on ceramics; Natal, Brazil; 24-27 Apr 1988)			
	14:31280	*See* INIS-BR–1507			
	14:32430	*See* INIS-BR–1513			
	14:32748	*See* INIS-BR–1505			
	14:32795	*See* INIS-BR–1511			
CONF-8804256–		(Conference on interfaces and ceramic joining; Petten, Netherlands; 20 Apr 1988)			
1	14:31287	*See* SAND–88-1112C			
CONF-880505–		(3. topical meeting on tritium technology in fission, fusion and isotopic applications; Toronto, Canada; 1-6 May 1988)			
	14:31981	*See* CEA-DAS–560			
CONF-880506–		(American Nuclear Society topical meeting on the safety of next generation power reactors; Seattle, Washington, USA; 1-6 May 1988)			
28	14:30926	*See* WHC-SA–0204			
CONF-880514–		(Workshop on biological assessment of occupational exposure to actinides; Versailles, France; 30 May - 2 jun 1988)			
Absts.	14:32368	NTIS (US Sales Only), PC A06/MF A01 - OSTI		DE89011549/JAW	MF-407
CONF-8805285–		(8. international Conference on plasma surface interactions; Juelich, Delaware, USA; 2-6 May 1988)			
	14:32861	*See* CEA-CONF–9639			
CONF-8805286–		(Synchrotron radiation in structural biology symposium; Upton, New York, USA; 22-25 May 1988)			
1	14:31588	*See* BNL–42275			
CONF-8805290–		(ASCE probabilistic methods conference; Blacksburg, Virginia, USA; 25-27 May 1988)			
	14:31686	*See* AUC-IBT-R–8806			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-880602–		(9. international catalysis congress; Calgary, Canada; 26 Jun - 1 jul 1988)			
5	14:31182	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013311/JAW	MF-401
CONF-880613–		(14. international symposium on effects of radiation on materials; Andover, Massachusetts, USA; 27-29 Jun 1988)			
31	14:31183	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012343/JAW	MF-000
CONF-8806169–		(4. annual Canadian/American conference on hydrogeology; Banff, Canada; 22-24 Jun 1988)			
3	14:32433	*See* LBL–26868			
CONF-8806235–		(International conference on advanced technology and particle physics; Como, Italy; 12-17 Jun 1988)			
	14:31813	*See* INFN-LNF–88-45(P)			
CONF-8806312–		(Coal derived fuels; Toronto, Canada; 5-10 Jun 1988)			
	14:31154	*See* EMR/TE–88-7			
CONF-8806362–		(ACS symposium on biomimetic catalysis; Toronto, Canada; 5-10 Jun 1988)			
1	14:30706	*See* LBL–25317			
CONF-8806365–		(Conference on non linear coherent structures in physics, mechanics and biological systems; Paris, France; 28-30 Jun 1988)			
	14:31181	*See* CEA-CONF–9758			
CONF-880587–		(13. international symposium on discharges and electrical insulation in vacuum; Paris, France; 27-30 Jun 1988)			
	14:31731	*See* CEA-CONF–9628			
CONF-880706–		(International quantum electronics conference; Tokyo, Japan; 18-22 Jul 1988)			
	14:31179	*See* CEA-CONF–9635			
CONF-880711–		(Small hydro '88: international conference and trade show; Toronto, Canada; 4-9 Jul 1988)			
	14:30676	*See* OME–1988			
CONF-8807123–		(Space cryogenics workshop; Frascati, Italy; 18-19 Jul 1988)			
2	14:31599	*See* LBL–25735			
CONF-8807164–		(IBM Europe Summer Istitute on advanced computering on the IBM 3090; Oberlech, Austria; 4-8 Jul 1988)			
	14:32907	*See* ENEA-RT-FUS–88-11			
CONF-8807166–		(Topical conference on particle physics and cosmology; Trieste, Italy; 25-28 Jul 1988)			
1	14:32618	*See* LBL–25784			
CONF-8807167–		(4. international workshop on recent developments in high energy physics; Chania, Greece; 1-10 Jul 1988)			
1	14:32819	*See* ANL-HEP-CP–88-84			
CONF-8807168–		(International conference on auroral physics; Cambridge, UK; 11-15 Jul 1988)			
	14:32479	*See* RAL–89-002			
CONF-880747–		(16. annual SLAC summer institute on particles physics; Stanford, California, USA; 18-29 Jul 1988)			
6	14:32549	*See* SLAC-PUB–4821			
CONF-880787–		(3. international symposium on the synthesis and applications of isotopically labeled compounds; Innsbruck, Austria; 17-21 Jul 1988)			
6	14:32210	*See* LBL–27196			
CONF-8808116–		(Sapporo international symposium: developments of nuclear cluster dynamics; Sapporo, Japan; 1-3 Aug 1988)			
	14:32654	*See* CRN-PN–88-24			
CONF-8808145–		(Meeting of the Division of Particles and Fields of the American Physical Society (APS); Storrs, Connecticut, USA; 15-18 Aug 1988)			
33	14:31704	*See* SLAC-PUB–4851			
CONF-8808150–		(Varenna-Abastumani workshop on plasma astrophysics; Varenna, Italy; 24 Aug - 3 sep 1988)			
2	14:32463	*See* UCRL–98769			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8808156–		(6. Japan-Brazil symposium on science and technology; Sao Paulo, Brazil; 10-12 Aug 1988)			
	14:32472	*See* ACIESP–60(v.3)			
CONF-8808225–		(DOE workshop on the role of a high-current accelerator in the future of nuclear medicine; Los Alamos, New Mexico, USA; 16-17 Aug 1988)			
	14:32348	*See* LA–11579-C			
CONF-880862–		(BNL workshop on glueballs, hybrids and exotic hadrons; Upton, New York, USA; 29 Aug - 1 sep 1988)			
	14:31708				
	14:31709				
	14:31857				
	14:31858				
	14:31859				
	14:32550				
	14:32551				
	14:32552				
	14:32553				
	14:32554				
	14:32555				
	14:32556				
	14:32557				
	14:32558				
	14:32559				
	14:32560				
	14:32561				
	14:32562				
	14:32563				
	14:32564				
	14:32565				
	14:32566				
	14:32567				
	14:32568				
	14:32594				
	14:32595				
	14:32597				
	14:32598				
	14:32599				
	14:32600				
	14:32601				
	14:32636				
CONF-880901–		(Metallurgical Society fall meeting and American Society for Metals materials week; Chicago, Illinois, USA; 24-30 Sep 1988)			
20	14:31224	*See* PNL-SA–15956			
CONF-880906–		(7. international conference on radiation shielding; Bournemouth, UK; 12-16 Sep 1988)			
	14:30856	*See* CEA-CONF–9695			
	14:32982	*See* CEA-CONF–9694			
CONF-880912–		(196. American Chemical Society national meeting; Los Angeles, California, USA; 25-30 Sep 1988)			
30	14:31394	*See* LBL–27014			
CONF-8809203–		(Quark Matter '88: 7th international conference on ultrarelativistic nucleus-nucleus collisions; Lenox, Massachusetts, USA; 26-30 Sep 1988)			
9	14:32680	*See* DOE/ER/40467–2			
CONF-8809223–		(Workshop on new directions in neutrino physics; Batavia, Illinois, USA; 14-16 Sep 1988)			
7	14:32546	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013631/JAW	MF-413
CONF-8809290–		(International conference on the physics of multiply-charged ions; Grenoble, France; 12-14 Sep 1988)			
2	14:31758	*See* LBL–25424			
CONF-8809314–		(International symposium on mathematical modeling of roof systems; Oak Ridge, Tennessee, USA; 15-16 Sep 1988)			
	14:31057	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012907/JAW	MF-350
CONF-8809329–		(Meeting on high temperature ceramic superconductors; Caen, France; 13-14 Sep 1988)			
	14:31268	*See* CEA-CONF–9672			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8809333–		(13. national meeting on mineral treatment and hydrometallurgy; Sao Paulo, Brazil; 26-29 Sep 1988)			
	14:30427	*See* INIS-BR–1454			
	14:31386	*See* INIS-BR–1453			
CONF-880955–		(International conference on the physics of multiply-charged ions; Grenoble, France; 12-14 Sep 1988)			
5	14:31758	*See* LBL–25424			
CONF-880983–		(8. international symposium on high energy spin physics; Minneapolis, Minnesota, USA; 12-17 Sep 1988)			
36-Rev.	14:31734	*See* DOE/ER/40150–68-Rev.			
CONF-8810118–		(Workshop on momentum distributions; Argonne, Illinois, USA; 24-26 Oct 1988)			
7	14:32835	*See* LA-UR–89-1604			
8	14:32506	*See* LA-UR–89-1607			
CONF-8810135–		(Switched-power workshop; Shelter Island, New York, USA; 16-21 Oct 1988)			
3	14:31783	*See* UCRL–100910			
4	14:31784	*See* UCRL–100911			
CONF-881018–		(58. Society of Exploration Geophysicists annual meeting; Anaheim, California, USA; 30 Oct - 3 nov 1988)			
2	14:32423	*See* UCRL–98720			
CONF-8810182–		(International collaboration on advanced neutron sources (ICANS); Los Alamos, New Mexico, USA; 3-7 Oct 1988)			
28	14:30646	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013624/JAW	MF-413
29	14:31788	*See* LA-UR–89-1575			
30	14:31694	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013184/JAW	MF-414
CONF-8810290–		(26. automotive technology development contractors' coordination meeting; Dearborn, Michigan, USA; 24-27 Oct 1988)			
2	14:31272	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013185/JAW	MF-336
CONF-8810306–		(Workshop on recent advances in biological sciences, low dose and low dose rate ionizing radiation; San Diego, California, USA; 18-20 Oct 1988)			
2	14:32367	*See* BNL–42416			
CONF-881031–		(8. topical meeting on technology of fusion energy; Salt Lake City, Utah, USA; 9-13 Oct 1988)			
70	14:32898	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012425/JAW	MF-424
CONF-8810351–		(Meeting on uranium; Montpellier, France; 10-12 Oct 1988)			
	14:31180	*See* CEA-CONF–9702			
CONF-8810359–		(Workshop on rules for exemption from regulatory control; Washington, D.C., USA; 17-19 Oct 1988)			
	14:30634	*See* NUREG/CP–0101			
CONF-8810366–		(2. Iberian-American congress of oncology; Salvador, Brazil; 9-14 Oct 1988)			
	14:32212	*See* INIS-BR–1516			
CONF-8810369–		(Workshop on microbial induced corrosion; Charlotte, North Carolina, USA; 18 Oct 1988)			
	14:30865	*See* EPRI-ER–6345			
CONF-881079–		(Superconductivity '88; Boston, Massachusetts, USA; 19 Oct 1988)			
2	14:31863	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013309/JAW	MF-114
CONF-8811100–		(5. state-of-the-art blast instrumentation; Albuquerque, New Mexico, USA; 15-16 Nov 1988)			
3	14:31865	*See* SAND–88-2907			
CONF-8811125–		(Rare decay symposium; Vancouver, Canada; 30 Nov - 3 dec 1988)			
9	14:32589	*See* LA-UR–89-1576			
CONF-8811147–		(Symposium on atomic scale calculations in materials science; Boston, Massachusetts, USA; 28-30 Nov 1988)			
3	14:31188	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013641/JAW	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8811202–		(4. annual DOE contractors' meeting on chemicals with living systems; Albuquerque, New Mexico, USA; 17-18 Nov 1988)			
	14:32395	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012820/JAW	MF-408
CONF-8811206–		(Conference on methods and tools of nuclear plants safety operations; Paris, France; 30 Nov - 1 dec 1988)			
	14:30863	*See* CEA-CONF–9717			
CONF-8811209–		(CP violation at KAON Factory; Vancouver, Canada; 30 Nov - 3 dec 1988)			
1	14:32545	*See* BNL–42535			
CONF-8811214–		(3. Latin-American colloquium about fatigue and fracture of materials; Rio de Janeiro, Brazil; 27 Nov - 2 dec 1988)			
	14:30429	*See* INIS-BR–1532			
	14:31210	*See* INIS-BR–1529			
	14:31281	*See* INIS-BR–1531			
	14:31282	*See* INIS-BR–1533			
	14:31389	*See* INIS-BR–1515			
	14:32797	*See* INIS-BR–1530			
CONF-881155–		(Fall meeting of the Materials Research Society; Boston, Massachusetts, USA; 28 Nov - 3 dec 1988)			
73	14:31184	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012407/JAW	MF-404
74	14:31185	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013177/JAW	MF-401
CONF-881174–		(Experimental mechanics in manufacturing and quality control; Indianapolis, Indiana, USA; 6-8 Nov 1988)			
4	14:31316	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013183/JAW	MF-404
CONF-881245–		(2. joint conference on integrating data for decision-making; Washington, D.C., USA; 12-14 Dec 1988)			
2	14:31918	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013181/JAW	MF-101
CONF-881276–		(Interface between computational science and nucleic acid sequencing; Santa Fe, New Mexico, USA; 12-16 Dec 1988)			
2	14:32174	*See* LA-UR–89-1788			
CONF-881282–		(Improving public awareness of the importance of coal and clean coal technology; Gaithersburg, Maryland, USA; 12-13 Dec 1988)			
	14:30283	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012919/JAW	MF-101
CONF-881286–		(Symposium on Nuclear Fuel Fabrication (NUFFAB '88); Bombay, Indiana, USA; 12-14 Dec 1988)			
	14:30847	*See* CEA-CONF–9719			
	14:30848	*See* CEA-CONF–9759			
CONF-881289–		(2. week of environment; Piracicaba, Brazil; 5-9 Dec 1988)			
	14:30880	*See* INIS-BR–1484			
	14:32008	*See* INIS-BR–1486			
	14:32358	*See* INIS-BR–1485			
CONF-890108–		(Ceramtec '89; Dearborn, Michigan, USA; 30 Jan - 2 feb 1989)			
1	14:31157	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012426/JAW	MF-336
CONF-8901118–		(Workshop on triggering and data acquisition for experiments at the Superconducting Super Collider; Toronto, Canada; 16-19 Jan 1989)			
3	14:31855	*See* SLAC-PUB–4966			
CONF-8901126–		(4. Brazilian school of semiconductor physics; Belo Horizonte, Brazil; 23 Jan - 3 feb 1989)			
	14:32787	*See* INIS-BR–1483			
CONF-8901127–		(Workshop on high energy physics phenomenology; Bombay, India; 2-15 Jan 1989)			
1	14:32580	*See* BNL–42537			
CONF-8901128–		(5. Jorge Andre Swieca summer school: particles and fields; Sao Paulo, Brazil; 8-21 Jan 1989)			
1	14:32544	*See* FNAL/C–89/70			
CONF-890124–		(American Association for the Advancement of Science (AAAS) annual meeting; San Francisco, California, USA; 14-19 Jan 1989)			
4	14:31169	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013630/JAW	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890145–		(SPIE conference on optics, electro-optics and laser applications in science and engineering: OE/LASE '89; Los Angeles, California, USA; 15-20 Jan 1989)			
25	14:33031	*See* UCRL–100789			
CONF-890165–		(Acta-scripta conference on metal-ceramic interfaces; Santa Barbara, California, USA; 15-19 Jan 1989)			
3	14:31186	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012396/JAW	MF-404
CONF-890177–		(Ethanol from biomass annual review meeting; Golden, Colorado, USA; 17-19 Jan 1989)			
2	14:30654	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013642/JAW	MF-246
CONF-890197–		(Advanced accelerator concepts workshop; Lake Arrowhead, California, USA; 9-13 Jan 1989)			
9	14:31697	*See* LBL–27059			
10	14:31722	*See* LBL–27092			
CONF-890199–		(8. Moriond workshop on tests of fundamental laws in physics; Les Arcs, France; Jan 1989)			
4	14:32581	*See* BNL–42715			
5	14:32842	*See* UCRL–101001			
CONF-890207–		(Waste management '89; Tucson, Arizona, USA; 26 Feb - 2 mar 1989)			
29	14:30613	*See* UCRL–100395			
30	14:32026	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012384/JAW	MF-511
31	14:30523	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012511/JAW	MF-70
32	14:30455	*See* BNL-NUREG–42595			
CONF-8902107–		(School on nuclear matter and heavy ion collisions; Les Houches, France; 7-16 Feb 1989)			
	14:31695	*See* GSI–89-31(prepr.)			
CONF-890231–		(5. international wire chamber conference; Vienna, Austria; 13-17 Feb 1989)			
4	14:31854	*See* SLAC-PUB–4956			
5	14:31852	*See* SLAC-PUB–4857			
6	14:31801	*See* ANL-HEP-CP–89-33			
7	14:31803	*See* BNL–42683			
CONF-890270–		(International industrial symposium on the super collider; New Orleans, Louisiana, USA; 8-10 Feb 1989)			
14	14:31800	*See* ANL-HEP-CP–89-12			
15	14:31764	*See* LBL–26247			
16	14:31766	*See* LBL–27062			
17	14:31763	*See* LBL–26244			
18	14:31825	*See* LBL–27063			
CONF-890277–		(Damping '89; Palm Beach, Florida, USA; 8-10 Feb 1989)			
1	14:31662	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010369/JAW	MF-504
CONF-890299–		(AHF accelerator design workshop; Los Alamos, New Mexico, USA; 20-25 Feb 1989)			
7	14:31757	*See* LA-UR–89-1600			
8	14:31696	*See* LA-UR–89-1599			
9	14:31752	*See* LA-UR–89-1497			
10	14:31756	*See* LA-UR–89-1574			
CONF-890306–		(Industry-university advanced materials conference; Denver, Colorado, USA; 6-9 Mar 1989)			
4	14:31269	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013623/JAW	MF-404
CONF-890309–		(INTERMAG: international magnetics conference; Washington, D.C., USA; 28-31 Mar 1989)			
1	14:31593	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013640/JAW	MF-330
CONF-8903111–		(Lunar planetary science conference; Houston, Texas, USA; 12-18 Mar 1989)			
3	14:32431	*See* LA-UR–89-1793			
CONF-8903117–		(Annual solar thermal technology research and development conference; Arlington, Virginia, USA; 8-9 Mar 1989)			
Vugraphs	14:30753	*See* SAND–89-0463			
CONF-8903124–		(Geothermal program review meeting; Washington, D.C., USA; 15 Mar 1989)			
1	14:30766	*See* BNL–42663			
CONF-890335–		(13. particle accelerator conference; Chicago, Illinois, USA; 20-23 Mar 1989)			
144	14:31780	*See* SLAC-PUB–4965			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
145	14:31728	*See* SLAC-PUB–4934			
146	14:31727	*See* SLAC-PUB–4933			
147	14:31779	*See* SLAC-PUB–4925			
148	14:31726	*See* SLAC-PUB–4924			
149	14:31778	*See* SLAC-PUB–4922			
150	14:31777	*See* SLAC-PUB–4921			
151	14:31781	*See* SLAC-PUB–4967			
152	14:31706	*See* SLAC-PUB–4975			
153	14:31769	*See* SLAC-PUB–4743			
154	14:31723	*See* SLAC-PUB–4835			
155	14:31768	*See* SLAC-PUB–4719-Rev.			
156	14:31774	*See* SLAC-PUB–4867			
157	14:31724	*See* SLAC-PUB–4872			
158	14:31775	*See* SLAC-PUB–4883			
159	14:31725	*See* SLAC-PUB–4898			
160	14:31776	*See* SLAC-PUB–4902			
161	14:31791	*See* SLAC-PUB–4905			
162	14:31792	*See* SLAC-PUB–4906			
163	14:31793	*See* SLAC-PUB–4913			
164	14:31794	*See* SLAC-PUB–4914			
165	14:31703	*See* SLAC-PUB–4849			
166	14:31770	*See* SLAC-PUB–4850			
167	14:31713	*See* FNAL/C–89/89			
167	14:31771	*See* SLAC-PUB–4861			
168	14:31772	*See* SLAC-PUB–4865			
169	14:31773	*See* SLAC-PUB–4866			
170	14:31692	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013305/JAW	MF-414
171	14:31785	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013285/JAW	MF-414
172	14:31693	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013303/JAW	MF-414
173	14:31755	*See* LA-UR–89-1573			
174	14:31754	*See* LA-UR–89-1572			
175-Vugraphs	14:31753	*See* LA-UR–89-1571			
176	14:31720	*See* LA-UR–89-1550			
177	14:31765	*See* LBL–26282			
178	14:32924	*See* LBL–25984			
179	14:31721	*See* LBL–25961			
180	14:31761	*See* LBL–25953			
181	14:31760	*See* LBL–25951			
182	14:31762	*See* LBL–25986			
183	14:31628	*See* LA-UR–89-1838			
184	14:31729	*See* UCRL–99593			
185	14:31707	*See* UCRL–99869			
186	14:31715	*See* FNAL/C–89/103			
187	14:31714	*See* FNAL/C–89/94			
CONF-890352–		(US Department of Energy research and development for the geothermal marketplace: 7th geothermal program review; San Francisco, California, USA; 21-23 Mar 1989)			
8	14:30772	*See* LBL–26898			
CONF-890379–		(Workshop on calorimetry for the SSC; Tuscaloosa, Alabama, USA; 13-17 Mar 1989)			
3	14:31807	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013041/JAW	MF-414
4	14:31808	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013042/JAW	MF-414
5	14:31811	*See* FNAL/C–89/109			
CONF-890401–		(197. national meeting of the American Chemical Society; Dallas, Texas, USA; 9-14 Apr 1989)			
12	14:30245	*See* BNL–41390			
CONF-890402–		(10. international conference on fluidized-bed combustion; San Francisco, California, USA; 30 Apr - 3 may 1989)			
6	14:30281	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013621/JAW	MF-103
CONF-890403–		(7. international stellarator workshop; Oak Ridge, Tennessee, USA; 10-14 Apr 1989)			
19	14:32862	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012337/JAW	MF-427
22	14:32863	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012969/JAW	MF-420
23	14:32899	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012970/JAW	MF-422
24	14:32900	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013048/JAW	MF-420
CONF-890406–		(Fifty years with nuclear fission conference; Gaithersburg, Maryland, USA; 25-28 Apr 1989)			
16	14:31632	*See* SAND–89-0953C			
17	14:30857	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012394/JAW	MF-520

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
18	14:32696	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013277/JAW	MF-516
19	14:30631	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013622/JAW	MF-506
20	14:32737	*See* LA-UR–89-1747			
CONF-8904107–		(2. international conference on high-density pinches (ICHDP-2); Laguna Beach, California, USA; 26-28 Apr 1989)			
2	14:31631	*See* SAND–89-0503C			
CONF-890415–		(Computing in high energy physics; Oxford, UK; 10-14 Apr 1989)			
1	14:31853	*See* SLAC-PUB–4940			
2	14:31804	*See* BNL–42688			
CONF-8904153–		(Symposium on nuclear dynamics and nuclear assembly; Dallas, Texas, USA; 9-14 Apr 1989)			
1	14:32670	*See* LBL–27019			
CONF-8904197–		(The energy/chemistry conference; Cairo, Egypt; 1-3 Apr 1989)			
2	14:30271	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012417/JAW	MF-105
CONF-8904201–		(American Nuclear Society meeting; Gaithersburg, Maryland, USA; 25-28 Apr 1989)			
3	14:32739	*See* LBL–27093			
CONF-8904203–		(Cell transformation systems relevant of radiation-induced cancer in man; Dublin, Ireland; 4-7 Apr 1989)			
1	14:32393	*See* PNL-SA–16186			
2	14:32371	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013196/JAW	MF-408
CONF-8904209–		(American Chemical Society Division of Agricultural and Food Chemistry symposium on copper bioavailability and metabolism; Dallas, Texas, USA; 10-14 Apr 1989)			
1	14:32349	*See* LA-UR–89-1207			
CONF-8904210–		(Cray user's group conference; Los Angeles, California, USA; 24-28 Apr 1989)			
1	14:32986	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012383/JAW	MF-405
2	14:33013	*See* UCRL–101060			
3	14:33004	*See* LA-UR–89-1832			
5	14:33003	*See* LA-UR–89-1693			
CONF-8904215–		(Symposium on fabrication and properties of lithium ceramics; Indianapolis, Indiana, USA; 24-26 Apr 1989)			
1	14:32927	*See* PNL-SA–16869			
CONF-8904216–		(Gamma ray observatory science workshop; Greenbelt, Maryland, USA; 10-12 Apr 1989)			
1	14:32462	*See* SAND–89-1234C			
2	14:32459	*See* LA-UR–89-1760			
3	14:32464	*See* UCRL–101121			
CONF-8904217–		(Short course on development of zonally-averaged models of the atmosphere; Louvain, Belgium; 17 Apr - 15 may 1989)			
1	14:31912	*See* UCRL–100817			
CONF-8904218–		(Eurocrypt '89; Houthalen, Belgium; 11-13 Apr 1989)			
1	14:33022	*See* SAND–89-0095C			
CONF-8904219–		(Atomic Energy Society of Japan meeting; Tokai-Mura, Japan; 4 Apr 1989)			
1	14:32987	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013620/JAW	MF-500
CONF-890425–		(American power conference; Chicago, Illinois, USA; 24-26 Apr 1989)			
3	14:30849	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012398/JAW	MF-530
CONF-890426–		(Spring meeting of the Materials Research Society; San Diego, California, USA; 24-28 Apr 1989)			
10	14:31317	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011569/JAW	MF-000
11	14:31270	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013299/JAW	MF-404
12	14:31271	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012416/JAW	MF-404
13	14:31393	*See* LA-UR–89-1471			
14	14:31283	*See* LBL–27094			
15	14:31332	*See* LA-UR–89-1722			
CONF-890435–		(6. international conference on high temperatures: chemistry of inorganic materials; Gaithersburg, Maryland, USA; 3-7 Apr 1989)			
3	14:31318	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013574/JAW	MF-404

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890436–		(American Society of Mechanical Engineers solar energy conference; San Diego, California, USA; 2-6 Apr 1989)			
11	14:30758	*See* SERI/TP–254-3453			
CONF-890485–		(25. annual meeting of the National Council on Radiation Protection and Measurements; Washington, D.C., USA; 4-7 Apr 1989)			
1	14:30895	*See* BNL-NUREG–42259			
CONF-890488–		(4. international symposium on ceramics in nuclear waste management; Indianapolis, Indiana, USA; 23-27 Apr 1989)			
8	14:30524	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013280/JAW	MF-512
CONF-890491–		(International conference on fifty years of research in nuclear fission; Berlin, Germany, F.R.; 3-7 Apr 1989)			
6	14:32681	*See* UCRL–100825			
7	14:32738	*See* LA-UR–89-1748			
CONF-890509–		(11. symposium on biotechnology for fuels and chemicals; Colorado Springs, Colorado, USA; 8-12 May 1989)			
1	14:30247	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012351/JAW	MF-108
CONF-890510–		(4. national conference on utility DSM programs: demand-site management strategies for the 90's; Cincinnati, Ohio, USA; 2-4 May 1989)			
Vol.1	14:31007	*See* EPRI-CU–6367-Vol.1			
CONF-8905105–		(3. international conference on numerical combustion; Antibes, France; 23-26 May 1989)			
2	14:31273	NTIS, PC A03/MF A01 - OSTI		DE89013628/JAW	MF-405;MN-406
CONF-8905107–		(SEM spring meeting; Cambridge, Massachusetts, USA; 28 May - 2 jun 1989)			
3	14:31110	*See* EGG-M–88355			
CONF-8905118–		(2. international conference on trends in welding research; Gatlinburg, Tennessee, USA; 15-19 May 1989)			
8	14:31274	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012421/JAW	MF-000
9	14:31275	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012419/JAW	MF-000
CONF-8905120–		(8. topical conference on radio frequency power in plasmas; Irvine, California, USA; 1-3 May 1989)			
8	14:32886	*See* UCRL–100577			
10	14:32901	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012362/JAW	MF-421
11	14:32871	*See* GA-A–19663			
12	14:32870	*See* GA-A–19662			
CONF-8905121–		(National conference of undergraduate research; San Antonio, Texas, USA; May 1989)			
1	14:32211	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010372/JAW	MF-408
2	14:31733	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012415/JAW	MF-420
CONF-8905127–		(3. National Water Well Association outdoor action conference; Orlando, Florida, USA; 22-25 May 1989)			
4	14:32419	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013615/JAW	MF-000
CONF-8905133–		(Workshop on high Tc superconductivity; Huntsville, Alabama, USA; 23-25 May 1989)			
2	14:31333	*See* LA-UR–89-1852			
CONF-8905134–		(JANNAF propulsion meeting; Cleveland, Ohio, USA; 22-25 May 1989)			
1	14:31895	*See* SAND–88-2813C			
CONF-8905135–		(DFS '89: Data Fusion symposium; Baltimore, Maryland, USA; 14 May 1989)			
1	14:32988	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011575/JAW	MF-000
CONF-8905136–		(Joint NEA/CEC workshop on sealing of radioactive waste repositories; Braunschweig, Germany, F.R.; 22-25 May 1989)			
1	14:30603	*See* SAND–89-1257C			
CONF-8905141–		(5. international conference on electrostatic accelerators and associated boosters; Strasbourg, France; 24-27 May 1989)			
1	14:32490	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012500/JAW	MF-411

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8905142–		(Annual meeting of the American Society for Microbiology; New Orleans, Louisiana, USA; 15-18 May 1989)			
1-Vugraphs	14:30248	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012493/JAW	MF-102
CONF-8905143–		(NATO international advanced courses on the nuclear equation of state; Peniscola, Spain; 12 May - 3 jun 1989)			
1	14:32740	*See* UCRL–100998			
CONF-890517–		(10. symposium on microdosimetry; Rome, Italy; 21-26 May 1989)			
1	14:32489	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013300/JAW	MF-407
CONF-890521–		(8. international conference on thermal destruction of hazardous, radioactive, infectious and mixed wastes; Knoxville, Tennessee, USA; 1-5 May 1989)			
8	14:30616	*See* WSRC-RP–89-12			
9	14:30540	*See* EGG-M–88480			
10	14:31919	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013172/JAW	MF-402
CONF-890546–		(Seminar on fission product transport processes in reactor accidents; Dubrovnik, Yugoslavia; 22-26 May 1989)			
6	14:30921	*See* SAND–89-1194C			
CONF-890548–		(16. conference for the electric power industry: reliability, availability, maintainability; Monterey, California, USA; 24-25 May 1989)			
1	14:30752	*See* SAND–89-0424C			
CONF-890560–		(12. international conference on cyclotrons and their applications; Berlin, Germany, F.R.; 8-12 May 1989)			
1	14:31786	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013055/JAW	MF-414
CONF-890565–		(11. annual ESARDA symposium on safeguards and nuclear materials management; , Luxembourg; 30 May - 1 jun 1989)			
1	14:30625	*See* K/ITP–237			
2	14:31598	*See* LA-UR–89-1685			
3	14:31473	*See* LA-UR–89-1684			
CONF-890575–		(Symposium on emerging technologies for hazardous waste treatment; Atlanta, Georgia, USA; 1-4 May 1989)			
2	14:32036	*See* LA-UR–89-1503			
CONF-890589–		(35. international instrumentation symposium; Orlando, Florida, USA; 30 May - 30 jun 1989)			
2	14:31677	*See* UCRL–53925			
CONF-890590–		(DOE computer security conference; Amarillo, Texas, USA; 2-4 May 1989)			
7	14:33002	*See* LA-UR–89-1511			
CONF-890604–		(Annual meeting of the American Nuclear Society; Atlanta, Georgia, USA; 4-8 Jun 1989)			
1	14:30440	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006634/JAW	MF-526
2	14:30875	*See* DP-MS–88-235			
3-Vugraphs	14:31654	*See* DP-MS–89-4			
4-Vugraphs	14:30900	*See* DP-MS–89-5			
CONF-890609–		(ASHRAE annual meeting; Vancouver, Canada; 24-28 Jun 1989)			
1	14:30536	*See* DP-MS–89-11			
3	14:31092	*See* SERI/TP–254-3478			
CONF-890610–		(ASES annual meeting and 14th annual passive solar conference; Denver, Colorado, USA; 19-23 Jun 1989)			
1	14:30751	*See* SAND–88-3027C			
2	14:31068	*See* LA-UR–89-1059			
3	14:33023	*See* SAND–89-0909C			
CONF-8906111–		(9. American Institute of Aeronautics and Astronautics (AIAA) computational fluid dynamics conference; Buffalo, New York, USA; 14-16 Jun 1989)			
1	14:32529	*See* UCRL–100879			
2	14:32530	*See* UCRL–100880			
CONF-8906113–		(DOE technical information meeting: INFOTECH; Oak Ridge, Tennessee, USA; 6-7 Jun 1989)			
1	14:32966	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012345/JAW	MF-400

CONF-8906113–

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
2	14:32989	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012350/JAW	MF-405
CONF-8906114–		(21. fracture symposium; Annapolis, Maryland, USA; 28-30 Jun 1989)			
1	14:31195	*See* EGG-M–88231			
CONF-8906115–		(VLSI multilevel interconnection conference; Santa Clara, California, USA; 12-14 Jun 1989)			
1	14:31675	*See* SAND–89-0486C			
CONF-8906118–		(International conference of the GTPS; La Grande Motte, France; 5-9 Jun 1989)			
1	14:31892	*See* SAND–88-2098C			
CONF-8906119–		(Powder metallurgy conference; San Diego, California, USA; 11-14 Jun 1989)			
1	14:31194	*See* DP-MS–88-213			
CONF-8906126–		(International conference on mechanics of two-phase flows; Taipei, Taiwan; 12-15 Jun 1989)			
1	14:31657	*See* SAND–88-2741C			
CONF-8906127–		(UGIM symposium; West Borough, Massachusetts, USA; 12-14 Jun 1989)			
1	14:31678	*See* UCRL–100861			
CONF-890617–		(2. Karlsruhe international conference on analytical chemistry in nuclear technology; Karlsruhe, Germany, F.R.; 5-9 Jun 1989)			
1	14:30441	*See* DP-MS–88-218			
CONF-890624–		(80. annual conference of the International District Heating and Cooling Association; Virginia Beach, Virginia, USA; 18-21 Jun 1989)			
1	14:31136	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013287/JAW	MF-350
CONF-890628–		(30. US symposium on rock mechanics; Morgantown, West Virginia, USA; 19-22 Jun 1989)			
1	14:30584	*See* SAND–88-2734C			
2	14:30583	*See* SAND–88-2650C			
3	14:30589	*See* SAND–88-3410C			
4	14:30582	*See* SAND–88-2535C			
5	14:32434	*See* SAND–88-2943C			
6	14:32435	*See* UCRL–99662			
7	14:30585	*See* SAND–88-2744C			
8	14:30579	*See* SAND–88-2230C			
9	14:32432	*See* LBL–26595			
10	14:30581	*See* SAND–88-2521C			
11	14:32429	*See* DP-MS–88-251			
CONF-890630–		(5. international conference on tribology; Helsinki, Finland; 12-15 Jun 1989)			
1	14:31187	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000614/JAW	MF-95
CONF-890631–		(International symposium on packaging and transporting of radioactive materials; Washington, D.C., USA; 11-16 Jun 1989)			
1	14:30448	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89001049/JAW	MF-513
1	14:30580	*See* SAND–88-2342C			
2	14:31604	*See* SAND–88-2287C			
3	14:31597	*See* K/CSD/INF–88/20			
4	14:31613	*See* SAND–89-1222C			
5	14:31612	*See* SAND–89-0938C			
6	14:31611	*See* SAND–89-0923C			
7	14:32754	*See* UCRL–99499			
8	14:31614	*See* SAND–89-1223C			
9	14:31606	*See* SAND–88-2827C			
10	14:30591	*See* SAND–89-0559C			
11	14:30598	*See* SAND–89-0935C			
12	14:31610	*See* SAND–89-0914C			
14	14:30592	*See* SAND–89-0560C			
15	14:30451	*See* SAND–89-0808C			
16	14:30586	*See* SAND–88-2778C			
17	14:31605	*See* SAND–88-2341C			
18	14:30525	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012506/JAW	MF-70
19	14:30593	*See* SAND–89-0608C			
20	14:30588	*See* SAND–88-2826C			
21	14:30599	*See* SAND–89-0937C			
23	14:30597	*See* SAND–89-0922C			
24	14:30594	*See* SAND–89-0807C			
25	14:30601	*See* SAND–89-1213C			
26	14:30595	*See* SAND–89-0915C			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
27	14:30596	*See* SAND–89-0921C			
28	14:30600	*See* SAND–89-0962C			
29	14:30587	*See* SAND–88-2823C			
30	14:30602	*See* SAND–89-1224C			
CONF-890634–		(Expert systems applications for the electric power industry conference; Orlando, Florida, USA; 5-8 Jun 1989)			
1	14:30791	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011613/JAW	MF-000
CONF-890646–		(International symposium on alloy 718 metallurgy and applications; Pittsburgh, Pennsylvania, USA; 12-14 Jun 1989)			
1	14:31227	*See* SAND–89-0264C			
2	14:31229	*See* SAND–89-0676C			
3	14:31226	*See* RFP–4330			
4	14:31225	*See* RFP–4329			
CONF-890654–		(Conference on programming language design and implementation; Portland, Oregon, USA; Jun 1989)			
2	14:33012	*See* UCRL–100156			
CONF-890657–		(33. annual meeting of the American Association of Cost Engineers; San Diego, California, USA; 25-28 Jun 1989)			
1	14:32983	NTIS, PC A03/MF A01 - OSTI		DE89005129/JAW	MF-705
2	14:32965	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008741/JAW	MF-400
CONF-890658–		(International symposium on nuclear decay data: spectrometric methods, measurements and evaluations; Braunschweig, Germany, F.R.; 6-8 Jun 1989)			
1	14:32692	*See* SAND–89-1101C			
CONF-890660–		(Institute of Electrical and Electronics Engineers (IEEE) Antennas Propagation Society (AP-S) international symposium; San Jose, California, USA; 26-30 Jun 1989)			
1	14:32840	*See* UCRL–100192			
2	14:31878	*See* UCRL–100185			
3	14:31868	*See* SAND–88-3389C			
4	14:31867	*See* SAND–88-3388C			
5	14:31879	*See* UCRL–100189			
6	14:31615	*See* SAND–89-7052C			
7	14:32841	*See* UCRL–100883			
CONF-890661–		(3. international symposium on behavior of media under high dynamic pressures; La Grande Motte, France; 5-9 Jun 1989)			
1	14:31782	*See* UCRL–98803			
2	14:31894	*See* LA-UR–88-4130			
3	14:32802	*See* UCRL–100168			
4	14:31623	*See* UCRL–98804			
5	14:31583	*See* SAND–88-1296C			
7	14:31897	*See* UCRL–100064			
8	14:31475	*See* SAND–89-0861C			
CONF-890662–		(6. international logic programming conference; Lisbon, Portugal; 19-23 Jun 1989)			
1	14:32984	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005804/JAW	MF-405
CONF-890664–		(3. international SAMPE electronics materials and processes conference; Los Angeles, California, USA; 19-22 Jun 1989)			
1	14:31331	*See* LA-UR–89-956			
CONF-890665–		(7. Institute of Electrical and Electronics Engineers pulsed power conference; Monterey, California, USA; 12-14 Jun 1989)			
1	14:31869	*See* SAND–88-3465C			
2	14:31672	*See* SAND–88-3356C			
4	14:32931	*See* SAND–89-0070C			
5	14:32930	*See* SAND–89-0031C			
6	14:31674	*See* SAND–89-0020C			
9	14:31701	*See* SAND–89-0069C			
10	14:31673	*See* SAND–88-3399C			
CONF-890676–		(2. international CIRP conference on new manufacturing technology; Cookeville, Tennessee, USA; 1-2 Jun 1989)			
1	14:31594	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006427/JAW	MF-406

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890677–		(4. international conference on boundary elements; Windsor, Canada; 6-8 Jun 1989)			
1	14:31603	*See* SAND–88-2115C			
CONF-890678–		(IEEE MTT-S international microwave symposium; Long Beach, California, USA; 13-15 Jun 1989)			
1	14:31870	*See* SAND–88-7169C			
CONF-890679–		(Optical Society of America signal recovery synthesis III; Cape Cod, Massachusetts, USA; 14-16 Jun 1989)			
1	14:31608	*See* SAND–89-0411C			
2	14:31607	*See* SAND–89-0157C			
CONF-890691–		(Society of American Value Engineers international conference; Indianapolis, Indiana, USA; 12-14 Jun 1989)			
1	14:32973	*See* UCRL–100655			
2	14:32968	*See* EGG-M–89013			
CONF-890692–		(82. Air and Waste Management Association annual meeting and exhibition; Anaheim, California, USA; 25-30 Jun 1989)			
1	14:30701	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008236/JAW	MF-402
2	14:31974	*See* UCRL–99927			
3	14:31975	*See* UCRL–99928			
4	14:31973	*See* UCRL–99926			
5	14:31995	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010319/JAW	MF-603
6	14:31920	NTIS, PC A03/MF A01 - OSTI		DE89011233/JAW	MF-402
7	14:31932	*See* LBL–26890			
8	14:31972	*See* UCRL–99883			
9	14:31921	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012359/JAW	MF-000
10	14:31094	*See* UCRL–100878			
11	14:31922	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013302/JAW	MF-603
12	14:31167	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013044/JAW	MF-000
CONF-890693–		(3. international conference on genetic algorithms; Washington, D.C., USA; 4-7 Jun 1989)			
1	14:33001	*See* LA-UR–89-760			
2	14:32985	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012508/JAW	MF-405
CONF-890694–		(Instrumentation for nuclear weapons effects testing conference; Monterey, California, USA; 5-8 Jun 1989)			
1	14:31851	*See* SAND–89-0188C			
2	14:31873	*See* SAND–89-0301C			
3	14:31676	*See* SAND–89-1085C			
5	14:31872	*See* SAND–89-0267C			
6	14:31874	*See* SAND–89-0337C			
7	14:31876	*See* SAND–89-1263C			
CONF-890695–		(4. international conference of the Israel Society for Ecology and the Environmental Quality Sciences; Jerusalem, Israel; 4-8 Jun 1989)			
1	14:31976	*See* UCRL–100721-Rev.1			
COO–					
2271-112	14:32582	*See* DOE/ER/02271–112			
2942-1	14:31279	*See* DOE/ET/25108–T1			
CRN-HE–					
86-09	14:31809	NTIS (US Sales Only), PC A07/MF A01		DE89776428/JAW	MF-000
CRN-PN–					
83-22	14:32697	NTIS (US Sales Only), PC A04/MF A01		DE89776426/JAW	MF-000
85-30	14:32698	NTIS (US Sales Only), PC A04/MF A01		DE89776427/JAW	MF-000
86-26	14:32699	NTIS (US Sales Only), PC A08/MF A01		DE89776434/JAW	MF-000
86-31	14:32663	NTIS (US Sales Only), PC A05/MF A01		DE89776439/JAW	MF-000
8630	14:32655	NTIS (US Sales Only), PC A02/MF A01		DE89776430/JAW	MF-000
88-24	14:32654	NTIS (US Sales Only), PC A02/MF A01		DE89776488/JAW	MF-000
CSIR-RR–					
494	14:31104	*See* PB–89-163505/XAB			
501	14:31105	*See* PB–89-163554/XAB			
CSST–					
1988	14:31058	Institut de recherche en sante et en securite du travail, Direction des communications, 505, boul. de Maisonneuve ouest, Montreal, PQ, Canada H3A 3C2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CTA-EAv-ENU-FR–					
001/81	14:32990	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614724/JAW	MF-000
002/81	14:30858	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614330/JAW	MF-000
CTA-EAv-IS–					
001/80	14:32645	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614722/JAW	MF-000
007/80	14:30859	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614331/JAW	MF-000
CTA-IEAV-RP–					
065/88	14:32995	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614730/JAW	MF-000
CTA-IEAv-ENU-FR–					
016/82	14:30860	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614332/JAW	MF-000
CTA-IEAv-NI-CPD-SC–					
014/82	14:32991	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614725/JAW	MF-000
CTA-IEAv-NI-ENU–					
001/83	14:32992	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614726/JAW	MF-000
CTA-IEAv-NT–					
007/88	14:30861	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614727/JAW	MF-000
009/88	14:30837	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614410/JAW	MF-000
CTA-IEAv-RI–					
003/83	14:32993	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614728/JAW	MF-000
006/83	14:30862	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614333/JAW	MF-000
CTA-IEAv-RP–					
019/88	14:30874	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614334/JAW	MF-000
023-88	14:31189	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614481/JAW	MF-000
024/88	14:32994	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614729/JAW	MF-000
CTH-IEFT-PP–					
1987-19	14:32902	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615584/JAW	MF-000
CU/KC–					
8809	14:31923	Alberta Legislative Library, 216 Legislature Bldg., Edmonton, AB, Canada T5K 2B6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
CUBRC–					
88682	14:31652	*See* AD-A–204364/4/XAB			
DCN–					
87-203-068-05-05	14:31945	*See* PB–89-161483/XAB			
DECG–					
S10-608	14:30272	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
DFVLR-FB–					
87-29	14:30756	NTIS (US Sales Only), PC A04/MF A01;1		DE89774606/JAW	MF-000
DOE-RW–					
88.067	14:30449	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616979/JAW	MF-000
88.100	14:30532	NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS		DE89614653/JAW	MF-000
88.106	14:30533	NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS		DE89614654/JAW	MF-000
88.109	14:32051	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616249/JAW	MF-000
88.110	14:31382	*See* AERE-R–12863			
89.023	14:30534	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89617423/JAW	MF-000
DOE/BC–					
88/3	14:30288	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000730/JAW	PC-122
DOE/BC/14152–					
2	14:30289	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013122/JAW	MF-122
DOE/BC/14304–					
T1	14:30286	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012489/JAW	MF-121;MN-131
DOE/BP/13795–					
20	14:31036	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013040/JAW	MF-350
DOE/BP/22493–					
4	14:30679	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013039/JAW	MF-600
DOE/BP/39166–					
2	14:31107	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013081/JAW	MF-220
3	14:31108	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013079/JAW	MF-220
DOE/BP/60288–					
2-Vol.1	14:31059	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013093/JAW	MF-350
DOE/CE/15323–					
T5	14:31190	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011827/JAW	MF-312

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/CE/26561–					
T1	14:31137	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012400/JAW	MF-350
DOE/CE/63522–					
T1	14:31060	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012404/JAW	MF-350
DOE/CH/10093–					
31	14:31109	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000803/JAW	MF-310
42	14:30784	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000857/JAW	MF-261
53	14:30702	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012254/JAW	MF-247
54	14:30703	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000869/JAW	MF-241;MN-242;MN-243;MN-244;MN-245;MN-246;MN-247;MN-248;MN-249
DOE/CH/10381–					
3	14:30306	National Consumer Law Center, 236 Massachusetts Ave, N.E., Washington, DC 20002			ND-121
DOE/EH–					
0073	14:30899	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012252/JAW	MF-630
0088	14:30526	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012243/JAW	MF-607
0089	14:30299	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012921/JAW	MF-630
DOE/EIA–					
0202(89/2Q)	14:30995	NTIS, PC A04/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89012562/JAW	MF-98
0455(87)	14:30792	NTIS, PC A13/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89012561/JAW	MF-98
0524	14:30300	NTIS, PC A03/MF A01 - GPO - OSTI; GPO Dep.	E 1.99:	DE89012563/JAW	MF-98
DOE/ER/02220–					
1	14:32543	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013603/JAW	MF-414
DOE/ER/02271–					
112	14:32582	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013113/JAW	MF-410
DOE/ER/10353–					
T1	14:32700	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013504/JAW	MF-413
T2	14:32701	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013503/JAW	MF-413
T3	14:32702	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013502/JAW	MF-413
DOE/ER/13083–					
T3	14:30290	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007559/JAW	MF-401
DOE/ER/13183–					
3	14:31276	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013030/JAW	MF-401
DOE/ER/13526–					
1	14:32172	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013198/JAW	MF-408
DOE/ER/13569–					
3	14:31466	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012949/JAW	MF-401
DOE/ER/13599–					
T1	14:31319	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012680/JAW	MF-404
DOE/ER/13612–					
1	14:31467	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013600/JAW	MF-401
DOE/ER/13717–					
1	14:30704	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013197/JAW	MF-408
DOE/ER/13729–					
1	14:32173	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012374/JAW	MF-408
DOE/ER/13745–					
2	14:32491	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012735/JAW	MF-411
DOE/ER/13782–					
3	14:31595	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012518/JAW	MF-406
DOE/ER/13912–					
1	14:31468	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012375/JAW	MF-401
DOE/ER/13933–					
1	14:31469	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013570/JAW	MF-401
DOE/ER/40063–					
13	14:32444	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013614/JAW	MF-412
DOE/ER/40150–					
68-Rev.	14:31734	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012227/JAW	MF-414
DOE/ER/40224–					
64	14:32583	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011411/JAW	MF-410
DOE/ER/40235–					
T5	14:32584	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012701/JAW	MF-414
DOE/ER/40306–					
1	14:31596	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013124/JAW	MF-406

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/ER/40372–					
02	14:31810	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013118/JAW	MF-414
DOE/ER/40465–					
T1	14:32864	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012403/JAW	MF-414;MN-420
DOE/ER/40467–					
2	14:32680	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013578/JAW	MF-414
DOE/ER/45063–					
4	14:31277	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013599/JAW	MF-404
DOE/ER/45211–					
13	14:31191	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012954/JAW	MF-404
DOE/ER/45255–					
3	14:31192	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012951/JAW	MF-404
DOE/ER/45269–					
3	14:31470	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013182/JAW	MF-401
DOE/ER/45298–					
2	14:31471	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012779/JAW	MF-401
DOE/ER/45310–					
18	14:32786	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012726/JAW	MF-404
DOE/ER/45311–					
2	14:31193	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013266/JAW	MF-404
DOE/ER/45359–					
1	14:31278	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012764/JAW	MF-404
DOE/ER/53207–					
4	14:32865	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012952/JAW	MF-420
DOE/ER/53252–					
13	14:32866	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012944/JAW	MF-420
DOE/ER/60255–					
5	14:31924	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011830/JAW	MF-408
DOE/ER/60336–					
5	14:32438	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005048/JAW	MF-403
DOE/ER/60517–					
3	14:31472	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012340/JAW	MF-401
DOE/ER/60546–					
4	14:31061	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013605/JAW	MF-402
DOE/ER/60664–					
1	14:31062	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013601/JAW	MF-407
DOE/ET/10815–					
127	14:31041	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013117/JAW	MF-112
DOE/ET/25108–					
T1	14:31279	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012230/JAW	MF-404
DOE/ET/53082–					
1	14:32903	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013225/JAW	MF-420
DOE/ET/53088–					
369	14:32703	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013314/JAW	MF-426
372	14:32867	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013315/JAW	MF-427
DOE/FE–					
0129	14:31042	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012232/JAW	MF-112
DOE/FTR–					
9011587	14:31735	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011587/JAW	MF-414
9012477	14:32492	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012477/JAW	MF-410
9012800	14:31736	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012761/JAW	MF-400
9013257	14:31712	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013257/JAW	MF-414
9013610	14:31737	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013610/JAW	MF-414;MN-405
9013613	14:32996	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013613/JAW	MF-405
DOE/ID–					
12114	14:30622	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013328/JAW	PC-602
DOE/ID/12584–					
29	14:30705	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012262/JAW	PC-511
38	14:31063	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013339/JAW	PC-511
39	14:30627	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012240/JAW	PC-511
43	14:31064	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013345/JAW	MF-511
DOE/LC/11062–					
2660	14:30420	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000909/JAW	PC-123;STD-123
DOE/MA–					
0372	14:32967	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012564/JAW	MF-13

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/MC/11076–					
2684	14:30391	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000964/JAW	MF-123
2687	14:30369	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000959/JAW	MF-123
2688	14:30392	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000960/JAW	MF-123
2690	14:30370	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000962/JAW	MF-123
DOE/MC/20422–					
2677	14:30314	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000968/JAW	PC-132;STD-132
DOE/MC/21136–					
20	14:30291	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012778/JAW	MF-122
DOE/MC/23087–					
2667	14:30249	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000945/JAW	PC-106;STD-106
DOE/MC/23126–					
2644	14:30250	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000920/JAW	PC-106;STD-106
DOE/MC/23167–					
2678-Vol.2	14:30793	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000954/JAW	MF-111
DOE/MC/24261–					
2672	14:31043	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000926/JAW	PC-110;STD-110
DOE/MC/24267–					
2664	14:30251	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000941/JAW	PC-109;STD-109
DOE/NV/10322–					
25	14:30527	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013205/JAW	MF-802
DOE/NV/10384–					
32	14:31982	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011839/JAW	MF-707;MN-702
DOE/NV/10461–					
T1-Vol.1	14:30528	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012958/JAW	MF-721;MN-702
DOE/OR/21389–					
16	14:30672	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012956/JAW	MF-247
17	14:31039	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012957/JAW	MF-247
DOE/OSTI–					
3406-Suppl.1-Add.2	14:30529	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005394/JAW	PC-70
DOE/PC/70018–					
22	14:30252	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013123/JAW	MF-108
27	14:30253	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013125/JAW	MF-108
37	14:30254	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013126/JAW	MF-108
40	14:30255	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013127/JAW	MF-108
59	14:30256	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013128/JAW	MF-108
60	14:30257	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013129/JAW	MF-108
62	14:30258	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013130/JAW	MF-108
65	14:30259	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013131/JAW	MF-108
DOE/PC/70809–					
T15	14:30260	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008184/JAW	PC-102;STD-102
DOE/PC/79818–					
T1	14:30261	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012651/JAW	MF-108
DOE/PC/80522–					
T7	14:30270	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012704/JAW	MF-102
DOE/PC/81012–					
T1-Pt.2	14:30803	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012481/JAW	PC-105;STD-105
DOE/PC/81201–					
T10	14:30262	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009049/JAW	PC-102;STD-102

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
DOE/PC/81582–					
T1	14:30273	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009081/JAW	PC-102;STD-102
DOE/PC/88861–					
T16	14:30650	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012695/JAW	MF-108
DOE/PC/88874–					
T3	14:30274	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012306/JAW	MF-105
DOE/PC/88883–					
T2	14:30239	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012305/JAW	MF-102
DOE/PC/88930–					
T2	14:30263	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012585/JAW	MF-108
DOE/PC/89904–					
T2	14:30240	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013667/JAW	MF-105
DOE/PC/91024–					
T10	14:30804	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012588/JAW	MF-105
DOE/RL–					
88-30-Vol.1	14:30530	NTIS, PC A22/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013037/JAW	MF-721
88-30-Vol.2	14:30531	NTIS, PC A21/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013038/JAW	MF-721
DOE/RW–					
0233	14:30535	OSTI		TI89011305/JAW	MF-70
DOE/SR/15191–					
2	14:32027	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012377/JAW	MF-702
DOE/SR/18001–					
2	14:30275	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012492/JAW	MF-708
DOE/WP/16151–					
3	14:30805	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012376/JAW	MF-600
DP-MS–					
88-213	14:31194	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010457/JAW	MF-704
88-218	14:30441	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011627/JAW	MF-702
88-235	14:30875	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007233/JAW	MF-706
88-251	14:32429	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010450/JAW	MF-702
89-4	14:31654	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010463/JAW	MF-705
89-5	14:30900	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010459/JAW	MF-705
89-11	14:30536	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006760/JAW	MF-706
DPHN–					
89-1	14:32650	NTIS (US Sales Only), PC A10/MF A01		DE89776467/JAW	MF-000
DPNU–					
80-50	14:32549	*See* SLAC-PUB–4821			
DPST–					
87-474	14:30537	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013480/JAW	MF-721
87-636	14:30538	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013481/JAW	MF-721
88-324-Rev.1	14:32052	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013472/JAW	MF-702
89-319	14:30539	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013499/JAW	MF-702
89-359	14:32033	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013471/JAW	MF-702
DS–					
096	14:30303	Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
DTH-AFM–					
88-12	14:30786	NTIS (US Sales Only), PC A05/MF A01;1		DE89776136/JAW	MF-000
DTH-LET-NE–					
88-1	14:31158	NTIS (US Sales Only), PC A06/MF A01;1		DE89776133/JAW	MF-000
DTH-LET-RE–					
88-8	14:30393	NTIS (US Sales Only), PC A05/MF A01;1		DE89766843/JAW	MF-000
EC–					
1988	14:30978	Atmospheric Environment Service, Climatological Services Division, Terrasses de la Chaudiere, 10 Wellington St., Hull, PQ, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EC/IWD–					
116	14:30304	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EC/IWD–					
1988	14:32034	Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, Canada K1A 0H3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ECN–					
214	14:32904	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89615590/JAW	MF-000
215	14:31925	NTIS (US Sales Only), PC A08/MF A01 - Netherlands Energy Research Foundation ECN, P.O. Box 1, 1755 ZG PETTEN, Netherlands		DE89766237/JAW	MF-000
EEV–					
88-02	14:30787	NTIS (US Sales Only), PC A03/MF A01;1		DE89766837/JAW	MF-000
EFM–					
880331	14:31320	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EGG-M–					
88231	14:31195	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011134/JAW	MF-406
88355	14:31110	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010976/JAW	MF-506
88480	14:30540	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011160/JAW	MF-510
89013	14:32968	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011126/JAW	MF-506
EI–					
8311	14:31065	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $3.40 CAN minimum, plus $0.25/p after 10 pages			ND-000
EMR–					
1986	14:31004	Petroleum Incentives Administration, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
M44-88/22E	14:32413	Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, Canada K1A 0S9; $5.00 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EMR/MS–					
87-6E	14:31111	Dept. of Regional Industrial Expansion, Public Information Branch, 235 Queen St., Ottawa, ON, Canada K1A 0H5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EMR/MTL–					
88-4	14:31196	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EMR/RE–					
8702	14:31040	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EMR/TE–					
88-7	14:31154	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ENEA-RT-FUS–					
88-10	14:32905	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612427/JAW	MF-000
88-11	14:32907	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89609811/JAW	MF-000
ENEA-RT-PAS–					
88-25	14:30901	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614346/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
EO–					
M27-89	14:30972	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
EPA/AA/CTAB–					
89/12	14:31160	*See* PB–89-159818/XAB			
EPRI-CS/EL–					
4415-Vol.6	14:30794	Research Reports Center, Box 50490, Palo Alto, CA 94303		DE89012763/JAW	ND-000
EPRI-CU–					
6367-Vol.1	14:31007	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-EA–					
5818-Vol.1	14:32035	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-EN–					
6391	14:32403	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-ER–					
6345	14:30865	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6399	14:30811	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-GS–					
6381	14:31112	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
EPRI-NP–					
5286	14:30866	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
5561-CCM-Vol.1-Rev.1	14:30838	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6341	14:30839	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6359-Vol.2	14:30902	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6362-M	14:30840	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6363	14:30821	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6375	14:30822	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6379	14:30876	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
6384-D	14:30867	Research Reports Center, Box 50490, Palo Alto, CA 94303			ND-000
ERA–					
87-0175	14:31067	*See* ERATL–89/16/XAB			
ERATL–					
89/16/XAB	14:31067	NTISPC$533.00			ND-00
ERCB–					
E87128/87-C	14:30318	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $N/C.			ND-000
ST88-47	14:30315	Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, Canada T2P 3G4; $N/C.			ND-000
ESA-SP–					
281	14:32445	NTIS (US Sales Only), PC A19/MF A01		DE89776503/JAW	MF-000
281	14:32446	NTIS (US Sales Only), PC A18/MF A01		DE89012116/JAW	MF-000
ESG–					
47	14:31759	*See* LBL–25610			
ESRG–					
87-102	14:31039	*See* DOE/OR/21389–17			
EUR–					
11187	14:30552	NTIS (US Sales Only), PC A06/MF A01			MF-000
11354-1	14:30553	NTIS (US Sales Only), PC A07/MF A01			MF-000
11354-2	14:30554	NTIS (US Sales Only), PC A10/MF A01			MF-000
11373	14:30903	NTIS (US Sales Only), PC A04/MF A01			MF-000
11489-1	14:30555	NTIS (US Sales Only), PC A08/MF A01			MF-000
11489-2	14:30556	NTIS (US Sales Only), PC A07/MF A01			MF-000
11489-3	14:30557	NTIS (US Sales Only), PC A08/MF A01			MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
11489-4	14:30558	NTIS (US Sales Only), PC A05/MF A01			MF-000
11489-5	14:30559	NTIS (US Sales Only), PC A07/MF A01			MF-000
11611	14:30560	NTIS (US Sales Only), PC A06/MF A01			MF-000
11627	14:30561	NTIS (US Sales Only), PC A03/MF A01			MF-000
11954	14:31983	NTIS (US Sales Only), PC A03/MF A01			MF-000
EUR-CEA-FC–					
1349	14:32869	NTIS (US Sales Only), PC A03/MF A01			MF-000
EWE–					
2618.028	14:30534	*See* DOE-RW–89.023			
FEI–					
1887	14:31738	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617006/JAW	MF-000
FLT–					
303701	14:31663	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
FMPC/Sub–					
014	14:30426	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012771/JAW	MF-704
FNAL/C–					
89/103	14:31715	NTIS, PC A02/MF A01 - OSTI		DE89013085/JAW	MF-414
89/109	14:31811	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013086/JAW	MF-414
89/70	14:32544	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012372/JAW	MF-414
89/89	14:31713	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012371/JAW	MF-414
89/94	14:31714	NTIS, PC A02/MF A01 - OSTI		DE89013084/JAW	MF-414
FO/CAR–					
1614	14:32028	Canada Dept. of Fisheries and Oceans, Scientific Info. & Pubs. Branch, 200 Kent Street, 14th. Floor, Ottawa, ON, Canada K1A 0E6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8812	14:32439	Dept. of Fisheries and Oceans, Scientific Info. & Pubs. Branch, 200 Kent Street, 14th. Floor, Ottawa, ON, Canada K1A 0E6; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
FOA-C–					
20679-9.2	14:32007	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616201/JAW	MF-000
FRCEA-TH–					
84	14:32651	NTIS (US Sales Only), PC A13/MF A01		DE89776432/JAW	MF-000
GA-A–					
19662	14:32870	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013308/JAW	MF-420
19663	14:32871	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013307/JAW	MF-414
GRI–					
88/0319	14:30321	NTIS, PC A17/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013596/JAW	MF-000
89/0049	14:31056	*See* BNL–42502			
GRR–					
8801	14:30336	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
GRS-F–					
171	14:30904	NTIS (US Sales Only), PC A04/MF A01		DE89774824/JAW	MF-000
GSF–					
14/88	14:32208	NTIS (US Sales Only), PC A05/MF A01		DE89774745/JAW	MF-000
GSI–					
89-07	14:31739	NTIS (US Sales Only), PC A06/MF A01		DE89774820/JAW	MF-000
89-08	14:32672	NTIS (US Sales Only), PC A07/MF A01		DE89774821/JAW	MF-000
89-23(prepr.)	14:32704	NTIS (US Sales Only), PC A03/MF A01		DE89774711/JAW	MF-000
89-24(prepr.)	14:32705	NTIS (US Sales Only), PC A03/MF A01		DE89774712/JAW	MF-000
89-29(prepr.)	14:32706	Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)			ND-000
89-30(prepr.)	14:32707	NTIS (US Sales Only), PC A03/MF A01		DE89774715/JAW	MF-000
89-31(prepr.)	14:31695	NTIS (US Sales Only), PC A03/MF A01		DE89774714/JAW	MF-000
89-32(prepr.)	14:31740	Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
HAC-REF-G–					
2937	14:31627	*See* AD-A–204225/7/XAB			
HASYLAB–					
84-03	14:31321	NTIS (US Sales Only), PC A09/MF A01		DE89774741/JAW	MF-000
HBC-REF–					
88-4261	14:30993	*See* PB–89-159107/XAB			
HEDL-SA–					
3698	14:32915	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011851/JAW	MF-530
3713	14:30850	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011855/JAW	MF-532
HEHF–					
54-88	14:32372	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013611/JAW	MF-408
HEPI–					
88-05	14:32585	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615712/JAW	MF-000
HETA–					
86-053-1933	14:31957	*See* PB–89-164727/XAB			
HHE–					
73-123-298	14:31962	*See* PB–89-166052/XAB			
74-009-174	14:31961	*See* PB–89-166003/XAB			
75-019-276	14:31959	*See* PB–89-165955/XAB			
75-087-280	14:31943	*See* PB–89-161251/XAB			
75-102-304	14:31960	*See* PB–89-165963/XAB			
75-121-281	14:31946	*See* PB–89-161657/XAB			
75-146-254	14:31964	*See* PB–89-166573/XAB			
76-006-294	14:31963	*See* PB–89-166300/XAB			
76-033-431	14:31944	*See* PB–89-161277/XAB			
77-031-432	14:31947	*See* PB–89-161673/XAB			
77-044-435	14:31948	*See* PB–89-161723/XAB			
HIFAN–					
416	14:32925	*See* LBL–27219			
HW–					
23642	14:32053	NTIS, PC A03/MF A01 - OSTI		DE89013132/JAW	MF-602
36819	14:30562	NTIS, PC A03/MF A01 - OSTI		DE89013133/JAW	MF-603
IAE–					
0043	14:31806	*See* CNIC–00171			
0045	14:32006	*See* CNIC–00175			
IAEA-R–					
4535/F	14:32758	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89616686/JAW	MF-000
IAPCM–					
0009	14:32897	*See* CNIC–00160			
IC–					
88/375	14:32710	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612846/JAW	MF-000
88/377	14:32820	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89611893/JAW	MF-000
88/423	14:32420	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613513/JAW	MF-000
IEACG–					
69064-01-SQ-FR	14:31138	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
69064-01-SQ-S	14:31139	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
IEN-DEMA–					
003/80	14:31197	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614718/JAW	MF-000
IEN-DQUI-DIQUI–					
03/80	14:31385	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613114/JAW	MF-000
04/80	14:31569	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613205/JAW	MF-000
IFSR–					
369	14:32703	*See* DOE/ET/53088–369			
372	14:32867	*See* DOE/ET/53088–372			
IFT-TD–					
11/87	14:32628	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89612009/JAW	MF-000
IFVE-OASU–					
88-91	14:32997	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89617496/JAW	MF-000
IFVE-OEA–					
88-73	14:31741	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617012/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
IFVE-ORI–					
88-85	14:31742	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617007/JAW	MF-000
IFVE-OUNK–					
88-15	14:31787	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617016/JAW	MF-000
88-55	14:31716	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616999/JAW	MF-000
IKE–					
2-84	14:31198	NTIS (US Sales Only), PC A05/MF A01		DE89774667/JAW	MF-000
ILL–					
9013157	14:31812	NTIS, PC A03/MF A01 - OSTI		DE89013157/JAW	MF-000
ILWRP–					
87-P14	14:31382	*See* AERE-R–12863			
INDC(BZL)–					
030/LJ	14:32711	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615775/JAW	MF-000
INDC(CCP)–					
290/LJ	14:32646	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615818/JAW	MF-000
292/L	14:32683	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613030/JAW	MF-000
293/L	14:32688	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89613037/JAW	MF-000
295/L	14:32690	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89613040/JAW	MF-000
INDC(CSR)–					
015/LJ	14:32714	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615776/JAW	MF-000
INFN-AE–					
88-12	14:32629	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612010/JAW	MF-000
88-13	14:32821	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89611970/JAW	MF-000
INFN-LNF–					
88-45(P)	14:31813	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614587/JAW	MF-000
INIS-BR–					
1443	14:31199	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89616020/JAW	MF-000
1453	14:31386	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613115/JAW	MF-000
1454	14:30427	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613116/JAW	MF-000
1459	14:31201	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613286/JAW	MF-000
1460	14:31202	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613287/JAW	MF-000
1461	14:31203	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613288/JAW	MF-000
1462	14:30868	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614347/JAW	MF-000
1463	14:31204	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613289/JAW	MF-000
1464	14:31205	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613247/JAW	MF-000
1465	14:30905	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614411/JAW	MF-000
1466	14:31206	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613290/JAW	MF-000
1467	14:30869	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614348/JAW	MF-000
1474	14:32969	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE89617502/JAW	MF-000
1477	14:31037	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE89614683/JAW	MF-000
1483	14:32787	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE89612194/JAW	MF-000
1484	14:30880	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613840/JAW	MF-000
1485	14:32358	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613791/JAW	MF-000
1486	14:32008	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613737/JAW	MF-000
1487	14:31388	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615865/JAW	MF-000
1501	14:32414	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE89613065/JAW	MF-000
1503	14:32415	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89613067/JAW	MF-000
1504	14:31991	NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS		DE89613483/JAW	MF-000
1505	14:32748	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612754/JAW	MF-000
1507	14:31280	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613397/JAW	MF-000
1509	14:31655	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614215/JAW	MF-000
1510	14:30851	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614482/JAW	MF-000
1511	14:32795	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612209/JAW	MF-000
1513	14:32430	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614731/JAW	MF-000
1514	14:32416	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613068/JAW	MF-000
1515	14:31389	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615841/JAW	MF-000
1516	14:32212	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE89613927/JAW	MF-000
1520	14:32796	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89612210/JAW	MF-000
1521	14:31209	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89613291/JAW	MF-000
1529	14:31210	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89616060/JAW	MF-000
1530	14:32797	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615450/JAW	MF-000
1531	14:31281	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613395/JAW	MF-000
1532	14:30429	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613223/JAW	MF-000
1533	14:31282	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613396/JAW	MF-000
INIS-GB–					
186	14:32454	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89615604/JAW	MF-000
187	14:32970	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89617503/JAW	MF-000
188	14:30563	NTIS (US Sales Only), PC A02/MF A01 - OSTI		DE89614664/JAW	MF-000
192	14:30855	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617451/JAW	MF-000
INIS-SU–					
74/A	14:32824	NTIS (US Sales Only), PC A05/MF A01		DE89012113/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
78	14:32647	NTIS (US Sales Only), PC A16/MF A01; INIS		DE89012115/JAW	MF-000
80	14:31173	NTIS (US Sales Only), PC A05/MF A01; INIS		DE89012114/JAW	MF-000
INIS-mf–					
11415	14:32652	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE89610045/JAW	MF-000
11422	14:30564	NTIS (US Sales Only), PC A18/MF A01 - OSTI; INIS		DE89614665/JAW	MF-000
11424	14:30648	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE89614199/JAW	MF-000
11426	14:32964	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE89614750/JAW	MF-000
11429	14:32715	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615756/JAW	MF-000
11430	14:30435	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617073/JAW	MF-000
11431	14:30436	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617074/JAW	MF-000
11432	14:32716	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615757/JAW	MF-000
11433	14:32717	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615814/JAW	MF-000
11434	14:32718	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615778/JAW	MF-000
11435	14:32009	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616547/JAW	MF-000
11436	14:32719	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615779/JAW	MF-000
11437	14:32720	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615780/JAW	MF-000
11439	14:32721	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615782/JAW	MF-000
11441	14:32971	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617504/JAW	MF-000
11442	14:30991	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89617452/JAW	MF-000
11444	14:30453	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617461/JAW	MF-000
11447	14:30623	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616600/JAW	MF-000
11935	14:30841	NTIS (US Sales Only), PC A11/MF A01		DE89775050/JAW	MF-000
11938	14:32343	NTIS (US Sales Only), PC A07/MF A01		DE89774679/JAW	MF-000
11939	14:32344	NTIS (US Sales Only), PC A06/MF A01		DE89774678/JAW	MF-000
11948	14:32665	NTIS (US Sales Only), PC A04/MF A01		DE89774670/JAW	MF-000
11949	14:32798	NTIS (US Sales Only), PC A07/MF A01		DE89774713/JAW	MF-000
11953	14:32209	NTIS (US Sales Only), PC A06/MF A01		DE89774609/JAW	MF-000
11954	14:32345	NTIS (US Sales Only), PC A04/MF A01		DE89774608/JAW	MF-000
11955	14:32346	NTIS (US Sales Only), PC A05/MF A01		DE89774607/JAW	MF-000
11956	14:32347	NTIS (US Sales Only), PC A06/MF A01		DE89774605/JAW	MF-000
11958	14:32547	NTIS (US Sales Only), PC A10/MF A01		DE89774795/JAW	MF-000
11959	14:32722	NTIS (US Sales Only), PC A15/MF A01		DE89774794/JAW	MF-000
4754(no.38)	14:32873	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE89615525/JAW	MF-000
IPEN-PUB–					
230	14:31390	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613070/JAW	MF-000
231	14:31391	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613071/JAW	MF-000
232	14:31213	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613340/JAW	MF-000
233	14:30624	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89613841/JAW	MF-000
IPNO-DRE–					
88-04	14:32732	NTIS (US Sales Only), PC A02/MF A01		DE89776440/JAW	MF-000
88-11	14:32669	NTIS (US Sales Only), PC A03/MF A01		DE89776489/JAW	MF-000
88-12	14:32664	NTIS (US Sales Only), PC A03/MF A01		DE89776490/JAW	MF-000
IREQ–					
146T328	14:30812	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
IRF-TR–					
34	14:32478	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613581/JAW	MF-000
ISH–					
124	14:32396	Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene			ND-000
ISI-A–					
10-387-0	14:30806	NTIS (US Sales Only), PC A06/MF A01;1		DE89774833/JAW	MF-000
ITEF–					
16(1988)	14:30842	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617197/JAW	MF-000
ITF–					
87-166	14:32630	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615386/JAW	MF-000
ITP–					
87-140	14:32617	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615405/JAW	MF-000
87-145	14:32586	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615721/JAW	MF-000
87-148	14:32733	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615786/JAW	MF-000
87-154	14:32631	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615387/JAW	MF-000
87-167	14:32587	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615713/JAW	MF-000
88-2	14:32734	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615787/JAW	MF-000
88-9	14:32588	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615722/JAW	MF-000
IVL-B–					
871	14:32359	NTIS (US Sales Only), PC A03/MF A01;1		DE89766910/JAW	MF-000
900	14:32397	NTIS (US Sales Only), PC A03/MF A01;1		DE89766891/JAW	MF-000
903	14:31113	NTIS (US Sales Only), PC A03/MF A01;1		DE89766931/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
916	14:31926	NTIS (US Sales Only), PC A03/MF A01;1		DE89766909/JAW	MF-000
IVO-A–					
03/88	14:30813	NTIS (US Sales Only), PC A05/MF A01		DE89766977/JAW	MF-000
IWS–					
093.27	14:31952	*See* PB–89-164677/XAB			
134.20.11	14:31953	*See* PB–89-164685/XAB			
143.22	14:31954	*See* PB–89-164693/XAB			
143.23	14:31955	*See* PB–89-164701/XAB			
158.12	14:31956	*See* PB–89-164719/XAB			
IYaF–					
88-7	14:32918	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615599/JAW	MF-000
88-14	14:32919	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615598/JAW	MF-000
88-16	14:31747	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617002/JAW	MF-000
88-21	14:31748	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617003/JAW	MF-000
88-25	14:31717	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617000/JAW	MF-000
88-35	14:32825	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615361/JAW	MF-000
88-41	14:31749	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614290/JAW	MF-000
88-45	14:32826	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615344/JAW	MF-000
88-47	14:32827	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615345/JAW	MF-000
88-52	14:32874	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615530/JAW	MF-000
88-74	14:32920	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615593/JAW	MF-000
88-76	14:32921	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615601/JAW	MF-000
88-80	14:31718	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614270/JAW	MF-000
88-81	14:32998	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614733/JAW	MF-000
88-86	14:32875	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615531/JAW	MF-000
88-92	14:32876	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615526/JAW	MF-000
JINR–					
9-88-356	14:31750	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89617014/JAW	MF-000
Juel–					
2222	14:31816	NTIS (US Sales Only), PC A06/MF A01		DE89774818/JAW	MF-000
2234	14:30906	NTIS (US Sales Only), PC A07/MF A01		DE89774819/JAW	MF-000
2235	14:31114	NTIS (US Sales Only), PC A06/MF A01;1		DE89774752/JAW	MF-000
2240	14:30845	NTIS (US Sales Only), PC A06/MF A01		DE89774817/JAW	MF-000
2243	14:31214	NTIS (US Sales Only), PC A08/MF A01		DE89774822/JAW	MF-000
2252	14:31323	NTIS (US Sales Only), PC A07/MF A01		DE89774744/JAW	MF-000
Juel-Spez–					
464	14:31580	NTIS (US Sales Only), PC A06/MF A01;1		DE89774739/JAW	MF-000
472	14:32735	NTIS (US Sales Only), PC A07/MF A01		DE89774615/JAW	MF-000
480	14:31817	NTIS (US Sales Only), PC A06/MF A01		DE89774680/JAW	MF-000
K/CSD/INF–					
88/20	14:31597	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011148/JAW	MF-513
K/D–					
5694	14:31907	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012734/JAW	MF-505
K/DSRD–					
96	14:32999	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013102/JAW	MF-705
K/ITP–					
237	14:30625	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012738/JAW	MF-511
269/P1	14:30432	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011788/JAW	MF-517
269/P3	14:30433	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011790/JAW	MF-517
269/P4	14:30434	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011791/JAW	MF-517
KCP–					
613-4101	14:31927	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013343/JAW	PC-702
KFK–					
4502	14:30442	NTIS (US Sales Only), PC A11/MF A01		DE89774751/JAW	MF-000
4508	14:32648	NTIS (US Sales Only), PC A08/MF A01		DE89774742/JAW	MF-000
4511	14:31928	NTIS (US Sales Only), PC A22/MF A01;1		DE89774668/JAW	MF-000
4521	14:30565	NTIS (US Sales Only), PC A09/MF A01		DE89774597/JAW	MF-000
4524	14:31392	NTIS (US Sales Only), PC A03/MF A01		DE89774677/JAW	MF-000
4528	14:32922	NTIS (US Sales Only), PC A03/MF A01		DE89774749/JAW	MF-000
4529	14:30566	NTIS (US Sales Only), PC A03/MF A01		DE89774750/JAW	MF-000
KIFVE–					
88-07	14:32632	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615388/JAW	MF-000
88-10	14:32799	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615481/JAW	MF-000
KIYI–					
88-4	14:32666	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615828/JAW	MF-000
88-6	14:32877	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615574/JAW	MF-000
88-8	14:31818	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617338/JAW	MF-000
88-10	14:32656	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615823/JAW	MF-000
88-18	14:32736	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615788/JAW	MF-000
88-22	14:32800	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615451/JAW	MF-000
88-26	14:31751	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89617015/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
88-29	14:31819	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617335/JAW	MF-000
88-30	14:31820	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617336/JAW	MF-000
88-31	14:32878	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615577/JAW	MF-000
88-32	14:32879	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615532/JAW	MF-000
88-33	14:31821	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617349/JAW	MF-000
88-35	14:32633	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615389/JAW	MF-000
88-36	14:33000	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617497/JAW	MF-000
88-40	14:31822	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617337/JAW	MF-000
KU-HCOE-FL2-R–					
88-22	14:32828	NTIS (US Sales Only), PC A02/MF A01		DE89775037/JAW	MF-000
88-24	14:32829	Also published in Phys. Rev. Lett. (10 Oct 1988) v. 61(15) p. 1679-1682.			MF-000
88-25	14:32816	NTIS (US Sales Only), PC A03/MF A01		DE89775035/JAW	MF-000
88-26	14:32830	NTIS (US Sales Only), PC A03/MF A01		DE89775034/JAW	MF-000
88-27	14:32831	NTIS (US Sales Only), PC A03/MF A01		DE89775033/JAW	MF-000
88-28	14:31324	NTIS (US Sales Only), PC A03/MF A01		DE89775032/JAW	MF-000
88-29	14:31325	NTIS (US Sales Only), PC A03/MF A01		DE89775031/JAW	MF-000
89-1	14:31326	Copenhagen Univ. (Denmark). H.C. Oersted Inst.			ND-000
89-2	14:31327	Copenhagen Univ. (Denmark). H.C. Oersted Inst.			ND-000
89-3	14:31328	Copenhagen Univ. (Denmark). H.C. Oersted Inst.			ND-000
89-4	14:31329	Copenhagen Univ. (Denmark). H.C. Oersted Inst.			ND-000
89-5	14:32832	NTIS (US Sales Only), PC A02/MF A01		DE89775038/JAW	MF-000
89-6	14:31330	NTIS (US Sales Only), PC A03/MF A01		DE89775039/JAW	MF-000
89-7	14:32833	NTIS (US Sales Only), PC A03/MF A01		DE89775046/JAW	MF-000
LA–					
10773-Add.	14:31893	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012259/JAW	PC-741
11419-MS	14:31899	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012260/JAW	PC-700
11506-PR	14:33025	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013334/JAW	PC-410;STD-700
11519-MS	14:32923	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012803/JAW	PC-426
11538-MS	14:31900	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012261/JAW	PC-700
11543-C	14:31215	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011401/JAW	MF-704;MN-705;MN-706
11557-MS	14:33026	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012804/JAW	PC-700
11560-MS	14:31161	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012805/JAW	PC-96
11561-MS	14:30988	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012798/JAW	PC-700
11573-MS	14:33027	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012826/JAW	PC-700
11575-T	14:32505	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013175/JAW	MF-411;MN-414
11579-C	14:32348	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011356/JAW	MF-408;MN-414
11588-MS	14:31216	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013655/JAW	MF-000
11596-MS	14:31823	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011846/JAW	MF-15;MN-706
11612-MS	14:31824	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012606/JAW	MF-706
LA-UR–					
88-4130	14:31894	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005459/JAW	MF-741
89-1059	14:31068	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009376/JAW	MF-232
89-1207	14:32349	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011190/JAW	MF-408
89-1471	14:31393	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012597/JAW	MF-704
89-1497	14:31752	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012596/JAW	MF-414
89-1503	14:32036	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012595/JAW	MF-721
89-1507	14:32458	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012594/JAW	MF-000
89-1511	14:33002	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012593/JAW	MF-705
89-1550	14:31720	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012609/JAW	MF-000
89-1571	14:31753	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013208/JAW	MF-414
89-1572	14:31754	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013207/JAW	MF-414
89-1573	14:31755	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013206/JAW	MF-414
89-1574	14:31756	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012770/JAW	MF-414
89-1575	14:31788	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012408/JAW	MF-414
89-1576	14:32589	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013446/JAW	MF-414
89-1599	14:31696	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012619/JAW	MF-414
89-1600	14:31757	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012618/JAW	MF-414
89-1604	14:32835	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012617/JAW	MF-410
89-1607	14:32506	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012615/JAW	MF-411

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-1684	14:31473	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013444/JAW	MF-701
89-1685	14:31598	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013443/JAW	MF-700
89-1693	14:33003	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013442/JAW	MF-705
89-1722	14:31332	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013439/JAW	MF-704
89-1747	14:32737	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013435/JAW	MF-413
89-1748	14:32738	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012733/JAW	MF-700
89-1760	14:32459	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013461/JAW	MF-700
89-1788	14:32174	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013457/JAW	MF-708
89-1793	14:32431	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013455/JAW	MF-000
89-1832	14:33004	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013264/JAW	MF-705
89-1838	14:31628	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013469/JAW	MF-700
89-1852	14:31333	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013467/JAW	MF-404
89-760	14:33001	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009407/JAW	MF-405
89-956	14:31331	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009273/JAW	MF-701
LAFI–					
127	14:32649	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615819/JAW	MF-000
LAL–					
88-21	14:32634	NTIS (US Sales Only), PC A14/MF A01		DE89776437/JAW	MF-000
88-53	14:32880	NTIS (US Sales Only), PC A03/MF A01		DE89776435/JAW	MF-000
LAL-RT–					
88-06	14:31719	NTIS (US Sales Only), PC A02/MF A01		DE89776420/JAW	MF-000
LAPP-EXP–					
88-05	14:32834	NTIS (US Sales Only), PC A02/MF A01		DE89776491/JAW	MF-000
LBH–					
184-612	14:31664	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
LBL–					
24212	14:31929	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013366/JAW	PC-400;STD-402
25317	14:30706	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011773/JAW	MF-401
25348-Rev.	14:31930	NTIS, PC A04/MF A01 - OSTI		DE89013364/JAW	PC-402
25424	14:31758	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010387/JAW	MF-404
25558	14:31038	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013361/JAW	MF-350
25586	14:32417	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013354/JAW	MF-000
25610	14:31759	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013359/JAW	PC-414
25611	14:30996	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013360/JAW	MF-000
25735	14:31599	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013431/JAW	MF-412
25769	14:30567	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013367/JAW	PC-403
25784	14:32618	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011771/JAW	MF-414
25951	14:31760	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012728/JAW	MF-414
25953	14:31761	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013189/JAW	MF-414
25961	14:31721	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012630/JAW	MF-414
25984	14:32924	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012743/JAW	MF-414
25986	14:31762	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013170/JAW	MF-414
26220	14:32801	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013353/JAW	PC-411
26244	14:31763	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012627/JAW	MF-414
26247	14:31764	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013429/JAW	MF-414
26282	14:31765	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013428/JAW	MF-414
26584	14:31931	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013355/JAW	PC-402
26585	14:30971	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012737/JAW	MF-350
26587	14:31069	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013357/JAW	PC-350
26595	14:32432	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009058/JAW	MF-403
26809	14:31792	*See* SLAC-PUB–4906			
26868	14:32433	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013423/JAW	MF-802
26890	14:31932	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010432/JAW	MF-402
26898	14:30772	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011820/JAW	MF-251
26974	14:31853	*See* SLAC-PUB–4940			
26976	14:31777	*See* SLAC-PUB–4921			
26977	14:31778	*See* SLAC-PUB–4922			
27011	14:31933	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012769/JAW	MF-402
27014	14:31394	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013420/JAW	MF-401
27019	14:32670	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011823/JAW	MF-413
27057	14:31776	*See* SLAC-PUB–4902			
27059	14:31697	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013427/JAW	MF-414
27062	14:31766	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013432/JAW	MF-414
27063	14:31825	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013190/JAW	MF-414

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
27092	14:31722	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012766/JAW	MF-414
27093	14:32739	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013421/JAW	MF-413
27094	14:31283	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012589/JAW	MF-404
27123	14:31551	NTIS, PC A18/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012768/JAW	MF-210
27147	14:31771	*See* SLAC-PUB–4861			
27196	14:32210	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013689/JAW	MF-401
27219	14:32925	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013352/JAW	PC-420
LHRL-LIB/Trans–					
4	14:31574	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615984/JAW	MF-000
LIR–					
01-89/331	14:32041	*See* PB–89-158604/XAB			
01-89/332	14:32042	*See* PB–89-158612/XAB			
01-89/333	14:32043	*See* PB–89-158620/XAB			
LITH-IKP-EX–					
680	14:31031	NTIS (US Sales Only), PC A05/MF A01;1		DE89766898/JAW	MF-000
690	14:31115	NTIS (US Sales Only), PC A05/MF A01;1		DE89766899/JAW	MF-000
LMF–					
122	14:30909	*See* NUREG/CR–5351			
LPI–					
520U527	14:31140	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
LPNHE–					
8701	14:32836	NTIS (US Sales Only), PC A03/MF A01		DE89776431/JAW	MF-000
LRAP–					
68	14:31581	NTIS (US Sales Only), PC A03/MF A01;1		DE89766901/JAW	MF-000
LUMEDW-MEKN–					
1004-1-139-1986	14:32360	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613792/JAW	MF-000
LUNFD6-TFME–					
1017-1-11-1988	14:32590	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612648/JAW	MF-000
LUNTDX-NTMX–					
7008-1-12-1988	14:31789	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614319/JAW	MF-000
LUTFD2-TFRT–					
5371-1-76-1987	14:30823	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE89614336/JAW	MF-000
LUTHD2-TFKF–					
1010-1-103-1988	14:32673	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613006/JAW	MF-000
MEC–					
628USOA	14:31141	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
MEM–					
1988	14:30998	Dept. of Energy and Mines, Legislative Bldg., Rm. 301, Winnipeg, MB, Canada R3C 0V8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MICROLOG–					
88-05003	14:31665	*See* SRC–8711			
88-05516	14:31917	*See* CANMET–8711			
88-05528	14:30336	*See* GRR–8801			
88-05567	14:31915	*See* BCMEP–8808			
88-05577	14:31914	*See* BCMEP–8801			
88-05585	14:30317	*See* BCPC–1988			
88-05587	14:31134	*See* BCMEP–8807			
88-05680	14:30276	*See* NBNRE–88-7			
88-05859	14:31166	*See* TEMP–AF-88-02			
88-06402	14:31129	*See* SC–2494CP			
89-00082	14:30277	*See* MU/B–8804			
89-00101	14:30308	*See* SRBM–1988			
89-00127	14:31997	*See* OE/ARB–218-87			
89-00226	14:30304	*See* EC/IWD–116			
89-00242	14:31970	*See* SSC/TLB–1988			
89-00360	14:30302	*See* COGLA–8809			
89-00374	14:31923	*See* CU/KC–8809			
89-00398	14:31682	*See* OME–1988			
89-00399	14:31120	*See* OME–8802			
89-00401	14:31119	*See* OME–8801			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-00406	14:31121	*See* ORF/ES–1988			
89-00453	14:31284	*See* NRCC/IMR–28898			
89-00454	14:32034	*See* EC/IWD–1988			
89-00464	14:30309	*See* TC/MCI–506			
89-00489	14:31196	*See* EMR/MTL–88-4			
89-00745	14:31154	*See* EMR/TE–88-7			
89-00769	14:31040	*See* EMR/RE–8702			
89-01021	14:31006	*See* BCH–1988			
89-01135	14:31117	*See* OAF/AEG–88-3301			
89-01137	14:31118	*See* OAF/AEG–88-5103			
89-01144	14:30972	*See* EO–M27-89			
89-01175	14:30978	*See* EC–1988			
89-01180	14:31994	*See* CCREM–8809			
89-01185	14:31152	*See* QME–1988			
89-01208	14:30303	*See* DS–096			
89-01211	14:32028	*See* FO/CAR–1614			
89-01227	14:32440	*See* SCR–073			
89-01228	14:31669	*See* MU/CCORE–091			
89-01232	14:31096	*See* MU/CRT–8706			
89-01255	14:32439	*See* FO/CAR–8812			
89-01266	14:30319	*See* NEB–23-27			
89-01284	14:30997	*See* NEB–23-15			
89-01292	14:31148	*See* NSME–8810			
89-01301	14:30976	*See* OH/EF–1988			
89-01317	14:31032	*See* OH/EF–269			
89-01318	14:30975	*See* OH/EF–281			
89-01319	14:30974	*See* OH/EF–256			
89-01320	14:30973	*See* OH/EF–245			
89-01358	14:31058	*See* CSST–1988			
89-01458	14:30307	*See* SJ–1989			
89-01497	14:31002	*See* SRBA–1987			
89-01517	14:30998	*See* MEM–1988			
89-01540	14:30305	*See* OE–8809			
89-01555	14:31934	*See* OE–8803			
89-01564	14:31996	*See* OE–8809			
89-01590	14:31128	*See* QER–6260			
89-01610	14:31111	*See* EMR/MS–87-6E			
89-01646	14:31935	*See* OME/APIOS–012-88			
89-01718	14:31076	*See* PW–87-8			
89-01719	14:31232	*See* WIC–RC262/4/88			
89-01720	14:31664	*See* LBH–184-612			
89-01722	14:30416	*See* CANMET–W13GEN-14			
89-01723	14:31681	*See* CANMET–5078-01			
89-01724	14:31138	*See* IEACG–69064-01-SQ-FR			
89-01724	14:31139	*See* IEACG–69064-01-SQ-S			
89-01725	14:31320	*See* EFM–880331			
89-01730	14:31338	*See* WIC–1988			
89-01731	14:30296	*See* PCPP/R–SP88-047			
89-01733	14:32422	*See* TAU–8704-1			
89-01743	14:31663	*See* FLT–303701			
89-01752	14:30272	*See* DECG–S10-608			
89-01764	14:31054	*See* AE/SESR–1989			
89-01781	14:30678	*See* BCH/RLM–8810			
89-01812	14:32413	*See* EMR–M44-88/22E			
89-01821	14:31077	*See* PW–87-9			
89-01822	14:31687	*See* MU/CCORE–88-12			
89-01869	14:31004	*See* EMR–1986			
89-01899	14:30977	*See* QER–E-21			
89-01908	14:31084	*See* PW–D09			
89-01909	14:31088	*See* PW–D35			
89-01910	14:31078	*See* PW–C1			
89-01913	14:31086	*See* PW–D33			
89-01915	14:31087	*See* PW–D34			
89-01916	14:31082	*See* PW–D04			
89-01917	14:31079	*See* PW–C2			
89-01920	14:31085	*See* PW–D10			
89-01921	14:31083	*See* PW–D06			
89-01922	14:31090	*See* PW–DO7			
89-01923	14:31089	*See* PW–D41			
89-01926	14:31081	*See* PW–D01			
89-01931	14:31080	*See* PW–C3			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-01937	14:30673	*See* NME–1986			
89-01938	14:30280	*See* NME–1985			
89-01939	14:32047	*See* STE–55			
89-01949	14:31219	*See* ORF–57-10480			
89-01949	14:31220	*See* ORF–57-10731			
89-01956	14:31680	*See* CANMET–88-60			
89-02318	14:31001	*See* OME–1988			
89-02657	14:30676	*See* OME–1988			
MLM–					
3586	14:31864	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012824/JAW	PC-406
MU/B–					
8804	14:30277	Manitoba Legislative Library, 200 Vaughan St., Winnipeg, MB, Canada R3C 1T5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MU/CCORE–					
091	14:31669	Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
88-12	14:31687	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
MU/CRT–					
8706	14:31096	Centre de recherche sur les transports, Universite de Montreal, CP 6128, Succursale A, Montreal, PQ, Canada H3C 3J7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
N–					
4577-2501	14:31074	*See* PB–89-173645/XAB			
NAC–					
87-10	14:32972	the CSIR, National Accelerator Centre, P.O. Box 72, Faure, South Africa			ND-000
NAGRA-NTB–					
86-24	14:31217	Nagra, CH-5401 Baden, Switzerland			ND-000
NBI-HE–					
88-80	14:33005	NTIS (US Sales Only), PC A03/MF A01		DE89775043/JAW	MF-000
89-01	14:32591	NTIS (US Sales Only), PC A03/MF A01		DE89775044/JAW	MF-000
89-06	14:32619	NTIS (US Sales Only), PC A02/MF A01		DE89775042/JAW	MF-000
89-07	14:32635	NTIS (US Sales Only), PC A03/MF A01		DE89775045/JAW	MF-000
NBNRE–					
88-7	14:30276	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NEB–					
23-15	14:30997	National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
23-27	14:30319	National Energy Board, Trebla Bldg., 473 Albert St., Ottawa, ON, Canada K1A 0E5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NEI-DK–					
154	14:31142	NTIS (US Sales Only), PC A06/MF A01;1		DE89766836/JAW	MF-000
155	14:30807	NTIS (US Sales Only), PC A03/MF A01;1		DE89766838/JAW	MF-000
156	14:31143	NTIS (US Sales Only), PC A04/MF A01;1		DE89766839/JAW	MF-000
158	14:31144	NTIS (US Sales Only), PC A03/MF A01;1		DE89766852/JAW	MF-000
159	14:31116	NTIS (US Sales Only), PC A17/MF A01;1		DE89766853/JAW	MF-000
160	14:31145	NTIS (US Sales Only), PC A05/MF A01;1		DE89766854/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
161	14:30795	NTIS (US Sales Only), PC A05/MF A01;1		DE89776140/JAW	MF-000
162	14:31670	NTIS (US Sales Only), PC A03/MF A01;1		DE89766863/JAW	MF-000
163	14:31044	NTIS (US Sales Only), PC A05/MF A01;1		DE89766864/JAW	MF-000
164	14:30788	NTIS (US Sales Only), PC A03/MF A01;1		DE89766865/JAW	MF-000
166	14:32175	NTIS (US Sales Only), PC A04/MF A01;1		DE89766868/JAW	MF-000
168	14:31146	NTIS (US Sales Only), PC A05/MF A01;1		DE89776122/JAW	MF-000
169	14:30750	NTIS (US Sales Only), PC A04/MF A01;1		DE89776134/JAW	MF-000
170	14:31147	NTIS (US Sales Only), PC A06/MF A01;1		DE89776135/JAW	MF-000
171	14:30757	NTIS (US Sales Only), PC A03/MF A01;1		DE89776137/JAW	MF-000
173	14:31334	NTIS (US Sales Only), PC A04/MF A01;1		DE89776153/JAW	MF-000
174	14:30960	NTIS (US Sales Only), PC AA08;3		DE89776152/JAW	MF-000
175	14:30999	NTIS (US Sales Only), PC A05/MF A01;1		DE89776159/JAW	MF-000
176	14:31000	NTIS (US Sales Only), PC A03/MF A01		DE89776160/JAW	MF-000
NEI-NO–					
63	14:31688	NTIS (US Sales Only), PC A10/MF A01		DE89766884/JAW	MF-000
NEI-SE–					
38	14:30907	NTIS (US Sales Only), PC A23/MF A01 - OSTI; INIS		DE89613823/JAW	MF-000
NIKHEF-K-LINO–					
151	14:31790	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614320/JAW	MF-000
NILU/OR–					
12/88	14:31908	NTIS (US Sales Only), PC A03/MF A01		DE89766873/JAW	MF-000
NIPER–					
264	14:30310	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000747/JAW	PC-125
319	14:30311	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000748/JAW	PC-125
323	14:30312	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000746/JAW	PC-125
385	14:30292	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000745/JAW	PC-122
390	14:30293	NTIS, PC A15/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000743/JAW	PC-122
395	14:30313	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000749/JAW	PC-125
NME–					
1985	14:30280	Dept. of Mines and Energy, PO Box 4750, St. John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1986	14:30673	Dept. of Mines and Energy, PO Box 4750, St. John's, NF, Canada A1C 5T7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NP–					
9774564	14:30264	NTIS (US Sales Only), PC A08/MF A01;1		DE89774564/JAW	MF-000
9774580	14:30287	NTIS (US Sales Only), PC A12/MF A01;1		DE89774580/JAW	MF-000
9774848	14:30754	NTIS (US Sales Only), PC A07/MF A01;1		DE89774848/JAW	MF-000
NPS–					
53-89-006	14:32975	*See* AD-A–204164/8/XAB			
NRC/BR–					
387	14:33020	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
859	14:31070	CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $0.34CAN per page, $3.40 CAN minimum			ND-000
NRCC/IMR–					
28898	14:31284	Canada Institute for Scientific and Technical Information, Montreal Rd., Ottawa, ON, Canada K1A 0S2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
NRL-MR–					
6453	14:32926	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012961/JAW	MF-712
NRL-R–					
2002-(S)	14:30449	*See* DOE-RW–88.067			
NSME–					
8810	14:31148	Nova Scotia Legislative Library, PO Box 396, Halifax, NS, Canada B3J 2P8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
NSS/R–					
126	14:31218	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616100/JAW	MF-000
132	14:32071	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616250/JAW	MF-000
NUCLEBRAS-CDTN–					
603	14:30890	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89614491/JAW	MF-000
NUREG–					
0020-Vol.13-No.4	14:30820	NTIS, PC A22/MF A01 - GPO - OSTI		TI89011834/JAW	MF-000
0386-Digest-5-Rev.1	14:30852	NTIS, PC A23/MF A01 - GPO - OSTI		TI89012439/JAW	MF-000
0540-Vol.2-No.3	14:30853	NTIS, PC A18/MF A01 - GPO - OSTI		TI89013272/JAW	MF-000
0896-Suppl.8	14:30908	NTIS, PC A05/MF A01 - GPO - OSTI		TI89012607/JAW	MF-000
NUREG/CP–					
0101	14:30634	NTIS, PC A14/MF A01 - GPO - OSTI		TI89011053/JAW	MF-000
NUREG/CR–					
5244	14:30824	NTIS, PC A04/MF A01 - GPO - OSTI		TI89013312/JAW	MF-000
5274	14:30877	NTIS, PC A13/MF A01 - GPO - OSTI		TI89012221/JAW	MF-000
5351	14:30909	NTIS, PC A04/MF A01 - GPO - OSTI		TI89013606/JAW	MF-000
5353	14:32376	NTIS, PC A09/MF A01 - GPO - OSTI		TI89012363/JAW	MF-000
NVO–					
314	14:31984	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011289/JAW	PC-707
NWPO-TR–					
001-87	14:30528	*See* DOE/NV/10461–T1-Vol.1			
OAF/AEG–					
88-3301	14:31117	Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C.			ND-000
88-5103	14:31118	Agricultural Energy Centre (Guelph Agriculture Centre), P.O. Box 1030, Guelph, ON, Canada N1H 6N1; $N/C.			ND-000
OE–					
8803	14:31934	Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8809	14:30305	Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8809	14:31996	Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OE/ARB–					
218-87	14:31997	Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, Canada M4V 1P5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OET/BULL–					
56	14:32406	*See* PB–89-165286/XAB			
OEVS-Mitteilung–					
1988	14:32377	NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS		DE89613806/JAW	MF-000
OH/EF–					
1988	14:30976	Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
245	14:30973	Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
256	14:30974	Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
OH/EF–					
269	14:31032	Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
281	14:30975	Ontario Hydro Research Division, Records Clerk, Bldg. KR 107, 800 Kipling Ave., Etobicoke, ON, Canada M8Z 5S4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OH/RD–					
004G213	14:30796	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON MEMBERS; MEMBERS PRICES UPON REQUEST, FUNDS CAN.			ND-000
072T223	14:30814	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
118-D-393	14:32404	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
177T510	14:30815	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.0-0 NON-MEMBERS; MEMBERS PRICES UPON REQUEST, FUNDS CAN.			ND-000
419G485	14:31671	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
513G543	14:30699	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
OITS–					
380	14:32583	*See* DOE/ER/40224–64			
OME–					
1988	14:30676	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CA			ND-000
1988	14:31001	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, Ont., Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
1988	14:31682	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
8801	14:31119	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, , Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
8802	14:31120	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, , Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
OME/APIOS–					
012-88	14:31935	Coordination Office, 40 St. Clair Avenue West, 7th Floor, Toronto, ON, Canada M4V 1M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ORF–					
57-10480	14:31219	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
57-10731	14:31220	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ORF/ES–					
1988	14:31121	Ontario Ministry of Energy, Communications Services Group, 62 Wellesley St., West, Main Floor, Toronto, ON, Canada M7A 2B7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
ORF/T–					
228U359	14:30816	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
ORNL–					
6404	14:30674	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012903/JAW	MF-000
6492	14:31936	NTIS, PC A16/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012900/JAW	MF-000
6521	14:31937	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012929/JAW	PC-402
6529	14:31174	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012905/JAW	PC-404
6544	14:31848	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012923/JAW	MF-407
ORNL/CDIAC–					
26	14:33021	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012911/JAW	MF-405
ORNL/CON–					
278	14:30797	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012925/JAW	MF-350
279	14:31071	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012800/JAW	MF-350
ORNL/CSD/TM–					
251	14:30569	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012901/JAW	PC-70
ORNL/M–					
329/R1	14:31072	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012797/JAW	MF-350
551/R1	14:31575	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012235/JAW	MF-517
755	14:31159	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012888/JAW	MF-96
775	14:32398	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012282/JAW	MF-000
829	14:32399	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012365/JAW	MF-000
ORNL/RASA–					
88/29	14:32021	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012739/JAW	MF-511
89/2	14:32022	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012756/JAW	MF-511
ORNL/Sub–					
86-95900/01	14:31221	NTIS, PC A03/MF A01 - OSTI		DE89011873/JAW	MF-114
89-21242/1	14:30570	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012257/JAW	MF-721
ORNL/TM–					
10735	14:32037	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012819/JAW	MF-401
10919	14:30571	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012906/JAW	MF-70
10921	14:31901	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013657/JAW	MF-000
11068	14:33007	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012912/JAW	MF-405
11079	14:33008	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012920/JAW	MF-506
11081	14:32409	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012931/JAW	MF-402
11135	14:32038	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012817/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
ORNL/TM–					
11143	14:33028	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013335/JAW	MF-000
11160	14:33029	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013321/JAW	MF-400
11199	14:31849	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013336/JAW	MF-414
ORNL/tr–					
89/10	14:30825	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012499/JAW	MF-400
89/7	14:30870	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008816/JAW	MF-520
PATENTS-USA–					
4,806,290	14:31381	Patent and Trademark Office, Box 9, Washington, DC 20232			
PATENTS-US–					
A7155451	14:32176	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011800/JAW	MF-708
A7212545	14:32177	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011808/JAW	MF-408
PB–					
89-149447/XAB	14:31171	NTIS, PC EE05/MF A01			ND-00
89-154884/XAB	14:32460	NTIS, PC EE02/MF A01			ND-00
89-156640/XAB	14:32039	NTIS, PC A04/MF A01			ND-00
89-156657/XAB	14:32040	NTIS, PC A21/MF A01			ND-00
89-158356/XAB	14:32461	NTIS, PC A03/MF A01			ND-00
89-158448/XAB	14:31097	NTIS, PC A03/MF A01			ND-00
89-158455/XAB	14:31098	NTIS, PC A05/MF A01			ND-00
89-158604/XAB	14:32041	NTIS, PC A13/MF A01			ND-00
89-158612/XAB	14:32042	NTIS, PC A12/MF A01			ND-00
89-158620/XAB	14:32043	NTIS, PC A10/MF A01			ND-00
89-158810/XAB	14:31122	NTIS, PC A07/MF A01			ND-00
89-158828/XAB	14:31123	NTIS, PC A15/MF A01			ND-00
89-159024/XAB	14:31938	NTIS, PC EE99/MF E99			ND-00
89-159032/XAB	14:31939	NTIS, PC A13/MF A01			ND-00
89-159040/XAB	14:31940	NTIS, PC A06/MF A01			ND-00
89-159057/XAB	14:31941	NTIS, PC A06/MF A01			ND-00
89-159065/XAB	14:31942	NTIS, PC A07/MF A01			ND-00
89-159107/XAB	14:30993	NTIS, PC A04/MF A01			ND-00
89-159149/XAB	14:30422	NTIS, PC A20/MF A01			ND-00
89-159156/XAB	14:30423	NTIS, PC A99/MF E04			ND-00
89-159164/XAB	14:30424	NTIS, PC A24/MF A01			ND-00
89-159172/XAB	14:30425	NTIS, PC A05/MF A01			ND-00
89-159305/XAB	14:31033	NTIS, PC A05/MF A01			ND-00
89-159818/XAB	14:31160	NTIS, PC A03/MF A01			ND-00
89-160089/XAB	14:31099	NTIS, PC A06/MF A01			ND-00
89-160238/XAB	14:31100	NTIS, PC A04/MF A01			ND-00
89-160246/XAB	14:31101	NTIS, PC A07/MF A01			ND-00
89-160253/XAB	14:31102	NTIS, PC A03/MF A01			ND-00
89-160261/XAB	14:31103	NTIS, PC A04/MF A01			ND-00
89-160691/XAB	14:32076	NTIS, PC A08/MF A01			ND-00
89-160998/XAB	14:30984	NTIS, PC A09/MF A01			ND-00
89-161251/XAB	14:31943	NTIS, PC A03/MF A01			ND-00
89-161277/XAB	14:31944	NTIS, PC A03/MF A01			ND-00
89-161483/XAB	14:31945	NTIS, PC A04/MF A01			ND-00
89-161517/XAB	14:32044	NTIS, PC A05/MF A01			ND-00
89-161657/XAB	14:31946	NTIS, PC A02/MF A01			ND-00
89-161673/XAB	14:31947	NTIS, PC A03/MF A01			ND-00
89-161723/XAB	14:31948	NTIS, PC A03/MF A01			ND-00
89-161764/XAB	14:31998	NTIS, PC A08/MF A01			ND-00
89-161863/XAB	14:31949	NTIS, PC A06/MF A01			ND-00
89-161954/XAB	14:31950	NTIS, PC A04/MF A01			ND-00
89-161962/XAB	14:31951	NTIS, PC A04/MF A01			ND-00
89-161970/XAB	14:31989	NTIS, PC A04/MF A01			ND-00
89-162036/XAB	14:31124	NTIS, PC A06/MF A01			ND-00
89-162044/XAB	14:30677	NTIS, PC A06/MF A01			ND-00
89-162069/XAB	14:30789	NTIS, PC A12/MF A01			ND-00
89-162218/XAB	14:30284	NTIS, PC A07			ND-00
89-162317/XAB	14:32075	NTIS, PC A03/MF A01			ND-00
89-162382/XAB	14:31149	NTIS, PC A08/MF A01			ND-00
89-162390/XAB	14:30323	NTIS, PC A05/MF A01			ND-00
89-162416/XAB	14:31125	NTIS, PC A06/MF A01			ND-00
89-163281/XAB	14:32045	NTIS, PC A03/MF A01			ND-00
89-163323/XAB	14:31163	NTIS, PC A05/MF A01			ND-00
89-163505/XAB	14:31104	NTIS, PC EE04/MF E04			ND-00
89-163554/XAB	14:31105	NTIS, PC EE04/MF E04			ND-00
89-164321/XAB	14:31126	NTIS, PC A14/MF A01			ND-00
89-164677/XAB	14:31952	NTIS, PC A03/MF A01			ND-00
89-164685/XAB	14:31953	NTIS, PC A03/MF A01			ND-00

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-164693/XAB	14:31954	NTIS, PC A03/MF A01			ND-00
89-164701/XAB	14:31955	NTIS, PC A03/MF A01			ND-00
89-164719/XAB	14:31956	NTIS, PC A03/MF A01			ND-00
89-164727/XAB	14:31957	NTIS, PC A03/MF A01			ND-00
89-164859/XAB	14:32410	NTIS, PC A07/MF A01			ND-00
89-164875/XAB	14:30322	NTIS, PC A03/MF A01			ND-00
89-165047/XAB	14:32405	NTIS, PC A04/MF A01			ND-00
89-165088/XAB	14:30808	NTIS, PC A03/MF A01			ND-00
89-165260/XAB	14:31150	NTIS, PC A07/MF A01			ND-00
89-165278/XAB	14:30809	NTIS, PC A08/MF A01			ND-00
89-165286/XAB	14:32406	NTIS, PC A03/MF A01			ND-00
89-165377/XAB	14:30651	NTIS, PC A08/MF A01			ND-00
89-165385/XAB	14:31151	NTIS, PC A17/MF A01			ND-00
89-165435/XAB	14:30994	NTIS, PC A04/MF A01			ND-00
89-165443/XAB	14:30979	NTIS, PC A08/MF A01			ND-00
89-165518/XAB	14:31164	NTIS, PC A09/MF A01			ND-00
89-165526/XAB	14:30316	NTIS, PC A06/MF A01			ND-00
89-165567/XAB	14:30798	NTIS, PC A14/MF A01			ND-00
89-165914/XAB	14:30707	NTIS, PC A15/MF A01			ND-00
89-165948/XAB	14:31958	NTIS, PC A04/MF A01			ND-00
89-165955/XAB	14:31959	NTIS, PC A03/MF A01			ND-00
89-165963/XAB	14:31960	NTIS, PC A03/MF A01			ND-00
89-166003/XAB	14:31961	NTIS, PC A03/MF A01			ND-00
89-166052/XAB	14:31962	NTIS, PC A03/MF A01			ND-00
89-166300/XAB	14:31963	NTIS, PC A02/MF A01			ND-00
89-166573/XAB	14:31964	NTIS, PC A03/MF A01			ND-00
89-166623/XAB	14:30810	NTIS, PC A05/MF A01			ND-00
89-166631/XAB	14:30799	NTIS, PC A99/MF A01			ND-00
89-166649/XAB	14:30800	NTIS, PC A09/MF A01			ND-00
89-167449/XAB	14:30320	NTIS, PC A03/MF A01			ND-00
89-167464/XAB	14:31073	NTIS, PC A05/MF A01			ND-00
89-167472/XAB	14:31165	NTIS, PC A04/MF A01			ND-00
89-167506/XAB	14:30980	NTIS, PC A03/MF A01			ND-00
89-168892/XAB	14:30265	NTIS, PC A11/MF A01			ND-00
89-168900/XAB	14:30266	NTIS, PC A10/MF A01			ND-00
89-173645/XAB	14:31074	NTIS, PC A04/MF A01			ND-00
89-178180/XAB	14:30652	NTIS, PC A03/MF A01			ND-00
89-178750/XAB	14:31046	NTIS, PC A06/MF A01			ND-00
89-178768/XAB	14:31047	NTIS, PC A10/MF A01			ND-00
89-179014/XAB	14:31999	NTIS, PC A99/MF E04			ND-00
89-859748/XAB	14:32400	NTISPC N01/MF N01			ND-00
89-859789/XAB	14:31222	NTISPC N01/MF N01			ND-00
89-859813/XAB	14:30981	NTISPC N01/MF N01			ND-00
89-859862/XAB	14:31965	NTISPC N01/MF N01			ND-00
89-859896/XAB	14:31285	NTISPC N01/MF N01			ND-00
89-859912/XAB	14:31629	NTISPC N01/MF N01			ND-00
89-859920/XAB	14:31630	NTISPC N01/MF N01			ND-00
89-859946/XAB	14:31474	NTISPC N01/MF N01			ND-00
89-859961/XAB	14:31902	NTISPC N01/MF N01			ND-00
89-859979/XAB	14:32353	NTISPC N01/MF N01			ND-00
89-860019/XAB	14:32407	NTISPC N01/MF N01			ND-00
89-860159/XAB	14:31127	NTISPC N01/MF N01			ND-00
89-860167/XAB	14:32411	NTISPC N01/MF N01			ND-00
89-860175/XAB	14:31286	NTISPC N01/MF N01			ND-00
89-860209/XAB	14:31601	NTISPC N01/MF N01			ND-00
89-860225/XAB	14:31656	NTISPC N01/MF N01			ND-00
89-860274/XAB	14:31223	NTISPC N01/MF N01			ND-00
89-860340/XAB	14:30982	NTISPC N01/MF N01			ND-00
89-860423/XAB	14:32000	NTISPC N01/MF N01			ND-00
89-860431/XAB	14:31602	NTISPC N01/MF N01			ND-00
89-860472/XAB	14:30919	NTISPC N01/MF N01			ND-00
89-860548/XAB	14:30962	NTISPC N01/MF N01			ND-00
PCPP/R–					
SP88-047	14:30296	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
PHS-PUB–					
2000	14:30284	*See* PB–89-162218/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
PNL–					
6450-18-HEDR	14:32390	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011853/JAW	MF-707
6450-19-HEDR	14:32391	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013082/JAW	MF-707
6599	14:30572	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013342/JAW	MF-510
6800-Pt.3	14:31986	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013340/JAW	MF-402
6815	14:31966	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012220/JAW	MF-502
6824	14:31967	NTIS, PC A11/MF A01 - OSTI		DE89012219/JAW	MF-502
6849	14:31075	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012822/JAW	MF-350
6862	14:32001	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012583/JAW	MF-502
6866	14:32392	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012625/JAW	MF-507
6877	14:30894	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012236/JAW	MF-731
6883	14:32046	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011355/JAW	MF-000
6884	14:30573	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012821/JAW	MF-811
6885	14:31968	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013341/JAW	MF-402
6891	14:32376	*See* NUREG/CR–5353			
PNL-SA–					
15956	14:31224	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011837/JAW	MF-404
16186	14:32393	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011208/JAW	MF-408
16869	14:32927	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011836/JAW	MF-420
PPPL–					
2609	14:32881	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012914/JAW	PC-420;STD-427
2612	14:32882	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012830/JAW	PC-426
2617	14:32507	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012829/JAW	PC-426
2619	14:32837	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013320/JAW	PC-427
2620	14:32883	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012828/JAW	PC-427
2621	14:32928	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013350/JAW	PC-421
2622	14:32884	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013121/JAW	PC-420;STD-427
2624	14:32885	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013349/JAW	PC-427
PSI–					
25	14:30920	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614403/JAW	MF-000
PTB-SE–					
7/2(rev.ed.)	14:30574	NTIS (US Sales Only), PC A04/MF A01		DE89774748/JAW	MF-000
PW–					
87-8	14:31076	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
87-9	14:31077	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
C1	14:31078	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
C2	14:31079	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
C3	14:31080	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
D01	14:31081	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D04	14:31082	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D06	14:31083	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D09	14:31084	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D10	14:31085	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D33	14:31086	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D34	14:31087	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D35	14:31088	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
D41	14:31089	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
DO7	14:31090	Public Works Canada, Information Research & Library Services, Sir Charles Tupper Bldg., Confederation Heights, Ottawa, ON, Canada K1A 0M2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
PWA–					
17/89	14:30442	*See* KFK–4502			
QCTF–					
87-P14	14:31382	*See* AERE-R–12863			
QER–					
6260	14:31128	Ministere de l'energie et des ressources, Direction des Communications, 200, chemin Ste-Foy, 7e etage, Quebec, PQ, Canada G1R 4X7; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
E-21	14:30977	Ministere de l'energie et des ressources, Direction des Communications, 200, chemin Ste-Foy, 7e etage, Quebec, PQ, Canada G1R 4X7; $N/C.			ND-000
QME–					
1988	14:31152	Ministere de l'environnement, 3900, rue Marly, Ste Foy, PQ, Canada G1X 4E4; $N/C; MF CAN-MET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
RAL–					
89-002	14:32479	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613582/JAW	MF-000
89-004	14:32752	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612747/JAW	MF-000
89-011	14:32592	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615723/JAW	MF-000
89-013	14:32753	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89615743/JAW	MF-000
89-014	14:31850	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617350/JAW	MF-000
REPT–					
7405-5	14:32410	*See* PB–89-164859/XAB			
88-1Q	14:30422	*See* PB–89-159149/XAB			
88-2Q	14:30423	*See* PB–89-159156/XAB			
88-3Q	14:30424	*See* PB–89-159164/XAB			
88/32	14:32460	*See* PB–89-154884/XAB			
RF/PRC/T–					
7/86	14:31689	NTIS (US Sales Only), PC A04/MF A01		DE89766876/JAW	MF-000
RFP–					
4329	14:31225	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010426/JAW	MF-704
4330	14:31226	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010427/JAW	MF-704
RI–					
202	14:31576	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615964/JAW	MF-000
RINPO–					
0002	14:30896	*See* CNIC–00088			
RISO-FGP-R–					
14-Rev.	14:30871	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011603/JAW	MF-523
16	14:30872	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011605/JAW	MF-523
RISO-M–					
2718	14:31909	NTIS (US Sales Only), PC A06/MF A01;1		DE89776150/JAW	MF-000
2765	14:32002	NTIS (US Sales Only), PC A03/MF A01;1		DE89776148/JAW	MF-000
2774	14:30989	NTIS (US Sales Only), PC A03/MF A01;1		DE89776149/JAW	MF-000
RISO-R–					
545	14:31582	NTIS (US Sales Only), PC A11;3		DE89776151/JAW	MF-000
RIVM–					
00-06	14:31969	NTIS (US Sales Only), PC A09/MF A01 - OSTI		DE89013199/JAW	MF-000
SAAS–					
365	14:30885	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89616597/JAW	MF-000
367	14:32777	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616948/JAW	MF-000
369	14:30575	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89617425/JAW	MF-000
370	14:32778	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616705/JAW	MF-000
SAND–					
86-2357	14:30576	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012947/JAW	MF-70
87-0754	14:30577	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012926/JAW	MF-512
88-0173	14:33009	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012255/JAW	MF-705
88-1112C	14:31287	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009323/JAW	MF-96
88-1156	14:30578	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012802/JAW	PC-70
88-1296C	14:31583	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007145/JAW	MF-706
88-2057	14:32929	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012799/JAW	PC-423
88-2098C	14:31892	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010437/JAW	MF-706
88-2115C	14:31603	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006328/JAW	MF-706
88-2230C	14:30579	NTIS, PC A02/MF A01 - OSTI		DE89007036/JAW	MF-70
88-2287C	14:31604	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009833/JAW	MF-722
88-2341C	14:31605	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013594/JAW	MF-722
88-2342C	14:30580	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013585/JAW	MF-722
88-2521C	14:30581	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010435/JAW	MF-721
88-2535C	14:30582	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005777/JAW	MF-721
88-2650C	14:30583	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005607/JAW	MF-702;MN-721
88-2734C	14:30584	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005207/JAW	MF-721
88-2741C	14:31657	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011850/JAW	MF-706
88-2744C	14:30585	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006724/JAW	MF-721
88-2778C	14:30586	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013595/JAW	MF-722

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
88-2813C	14:31895	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012497/JAW	MF-704
88-2823C	14:30587	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012656/JAW	MF-722
88-2826C	14:30588	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012572/JAW	MF-513
88-2827C	14:31606	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012569/JAW	MF-513
88-2907	14:31865	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013348/JAW	MF-706
88-2943C	14:32434	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005919/JAW	MF-702
88-3016	14:33010	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012815/JAW	MF-700
88-3027C	14:30751	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89003912/JAW	MF-235
88-3118	14:31335	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012794/JAW	PC-741
88-3153	14:31866	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013141/JAW	MF-700
88-3341	14:31903	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012258/JAW	MF-704
88-3356C	14:31672	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012657/JAW	MF-706
88-3388C	14:31867	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005209/JAW	MF-706
88-3389C	14:31868	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005346/JAW	MF-700
88-3399C	14:31673	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013073/JAW	MF-706
88-3410C	14:30589	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005597/JAW	MF-721
88-3465C	14:31869	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011886/JAW	MF-706
88-7036-Pt.1	14:30747	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013346/JAW	MF-270
88-7036-Pt.2	14:30748	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013333/JAW	MF-270
88-7042	14:30749	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013330/JAW	MF-276
88-7169C	14:31870	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005917/JAW	MF-706
89-0020C	14:31674	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013072/JAW	MF-706
89-0031C	14:32930	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013068/JAW	MF-712
89-0069C	14:31701	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013075/JAW	MF-700
89-0070C	14:32931	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013071/JAW	MF-712
89-0095C	14:33022	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012568/JAW	MF-700
89-0106C	14:31331	*See* LA-UR–89-956			
89-0157C	14:31607	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007085/JAW	MF-706
89-0178	14:30590	NTIS, PC A20/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012559/JAW	MF-721
89-0188C	14:31851	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009327/JAW	MF-706
89-0242	14:31871	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012896/JAW	MF-406
89-0264C	14:31227	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008196/JAW	MF-704
89-0267C	14:31872	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010743/JAW	MF-706
89-0298	14:31767	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000868/JAW	MF-414
89-0301C	14:31873	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009945/JAW	MF-706
89-0337C	14:31874	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010863/JAW	MF-742
89-0341	14:30285	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013331/JAW	MF-126
89-0411C	14:31608	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007086/JAW	MF-706
89-0424C	14:30752	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007639/JAW	MF-235
89-0463	14:30753	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010538/JAW	MF-234
89-0486C	14:31675	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011066/JAW	MF-706
89-0489	14:31228	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012247/JAW	MF-700
89-0503C	14:31631	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013069/JAW	MF-741
89-0512	14:31896	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011297/JAW	PC-700
89-0559C	14:30591	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013590/JAW	MF-722
89-0560C	14:30592	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013591/JAW	MF-721
89-0593	14:31875	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012823/JAW	MF-706
89-0608C	14:30593	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013602/JAW	MF-722
89-0671	14:31609	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012813/JAW	PC-406
89-0676C	14:31229	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009069/JAW	MF-706
89-0807C	14:30594	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012641/JAW	MF-722
89-0808C	14:30451	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013581/JAW	MF-722
89-0842	14:31336	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013329/JAW	MF-406
89-0861C	14:31475	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010769/JAW	MF-701
89-0909C	14:33023	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009978/JAW	MF-233
89-0914C	14:31610	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013583/JAW	MF-722
89-0915C	14:30595	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012659/JAW	MF-722
89-0921C	14:30596	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012640/JAW	MF-722
89-0922C	14:30597	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012642/JAW	MF-722
89-0923C	14:31611	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011885/JAW	MF-722
89-0935C	14:30598	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013589/JAW	MF-722
89-0937C	14:30599	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013447/JAW	MF-722
89-0938C	14:31612	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011884/JAW	MF-722
89-0953C	14:31632	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010329/JAW	MF-706
89-0962C	14:30600	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012655/JAW	MF-722
89-1085C	14:31676	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010861/JAW	MF-706
89-1101C	14:32692	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011844/JAW	MF-713
89-1194C	14:30921	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011882/JAW	MF-000
89-1213C	14:30601	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012660/JAW	MF-722
89-1222C	14:31613	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011879/JAW	MF-722
89-1223C	14:31614	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012571/JAW	MF-700

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89-1224C	14:30602	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013166/JAW	MF-722
89-1234C	14:32462	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011840/JAW	MF-412
89-1257C	14:30603	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011394/JAW	MF-721
89-1263C	14:31876	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010864/JAW	MF-706;MN-705
89-7052C	14:31615	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006769/JAW	MF-706
89-8228	14:30983	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012814/JAW	MF-700
89-8235	14:30282	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012816/JAW	MF-113
SC–					
2494CP	14:31129	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, , Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
653U604	14:30817	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
SCC–					
88-01	14:32366	*See* AD-A–204598/7/XAB			
88-04	14:32365	*See* AD-A–204597/9/XAB			
89-01	14:32443	*See* AD-A–204599/5/XAB			
SCR–					
073	14:32440	Canada Oil and Gas Lands Administration, 355 River Rd., 15th Floor, Tower B, Ottawa, ON, Canada K1A 0E4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SERI/PR–					
211-3483	14:30708	NTIS, PC A14/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000898/JAW	MF-270
SERI/SP–					
211-3488	14:30709	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000883/JAW	MF-270
220-3458	14:30700	NTIS, PC A03/MF A01 - OSTI		DE89000851/JAW	MF-234
SERI/STR–					
217-3476	14:30790	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000888/JAW	MF-261
SERI/TP–					
254-3049	14:31091	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000850/JAW	MF-234
254-3453	14:30758	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000842/JAW	MF-234
254-3478	14:31092	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000875/JAW	MF-231
SERI/TR–					
213-3472	14:30738	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000896/JAW	MF-270
SFB–					
151-7	14:30922	Copy held by UB/TIB Hannover.			MF-000
237-39(prepr.)	14:32838	Bochum Univ. (Germany, F.R.). Sonderforschungsbereich 237 - Unordnung und Grosse Fluktuationen			ND-000
SGD–					
438-PT-2	14:32461	*See* PB–89-158356/XAB			
SHA–					
527U537	14:31130	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
SJ–					
1989	14:30307	Saskatchewan Legislative Library, Government Publications, 234 Legislative Bldgs., Regina, SK, Canada S4S 0B3; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SKB-JSSP-TR–					
88-01	14:30604	NTIS (US Sales Only), PC A11/MF A01 - OSTI; INIS		DE89614667/JAW	MF-000
SKB-TR–					
88-21	14:31577	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89613120/JAW	MF-000
88-23	14:32421	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89613520/JAW	MF-000
SKI–					
87101	14:31987	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613557/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SKN–					
20	14:30605	NTIS (US Sales Only), PC A03/MF A01		DE89775048/JAW	MF-000
21	14:30606	NTIS (US Sales Only), PC A03/MF A01		DE89775049/JAW	MF-000
SLAC–					
341	14:31702	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013316/JAW	MF-414
342	14:32548	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012827/JAW	PC-414
SLAC-PUB–					
4719-Rev.	14:31768	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012792/JAW	PC-414
4743	14:31769	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012791/JAW	PC-414
4821	14:32549	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011279/JAW	PC-414
4835	14:31723	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012790/JAW	PC-414
4849	14:31703	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012789/JAW	PC-414
4850	14:31770	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012788/JAW	PC-414
4851	14:31704	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012787/JAW	PC-414
4857	14:31852	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012786/JAW	PC-414
4861	14:31771	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012785/JAW	PC-414
4865	14:31772	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012784/JAW	PC-414
4866	14:31773	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012783/JAW	PC-414
4867	14:31774	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012782/JAW	PC-414
4872	14:31724	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012781/JAW	PC-414
4883	14:31775	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012281/JAW	PC-414
4894	14:31705	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011282/JAW	PC-414
4898	14:31725	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012280/JAW	PC-414
4902	14:31776	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012279/JAW	PC-414
4905	14:31791	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012278/JAW	PC-414
4906	14:31792	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012277/JAW	PC-414
4913	14:31793	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012276/JAW	PC-414
4914	14:31794	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012275/JAW	PC-414
4921	14:31777	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012274/JAW	PC-414
4922	14:31778	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012273/JAW	PC-414
4924	14:31726	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012272/JAW	PC-414
4925	14:31779	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012271/JAW	PC-414
4933	14:31727	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012270/JAW	PC-414
4934	14:31728	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012269/JAW	PC-414
4940	14:31853	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012268/JAW	PC-414
4956	14:31854	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012267/JAW	PC-414
4965	14:31780	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012266/JAW	PC-414
4966	14:31855	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012265/JAW	PC-414
4967	14:31781	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012264/JAW	PC-414
4975	14:31706	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012263/JAW	PC-414
SLU-LBT–					
63	14:30755	NTIS (US Sales Only), PC A04/MF A01;1		DE89766896/JAW	MF-000
SNV–					
3399	14:32779	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89613901/JAW	MF-000
3447	14:32074	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616624/JAW	MF-000
3462	14:30886	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613842/JAW	MF-000
3463	14:30887	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613838/JAW	MF-000
3520	14:32003	NTIS (US Sales Only), PC A04/MF A01;1		DE89766911/JAW	MF-000
3533	14:32401	NTIS (US Sales Only), PC A03/MF A01;1		DE89766913/JAW	MF-000
3552	14:32004	NTIS (US Sales Only), PC A04/MF A01;1		DE89766912/JAW	MF-000
SRBA–					
1987	14:31002	Alberta. Surface Rights Board, 18th Floor, Phipps-McKinnon Bldg., 10020-101A Ave., Edmonton, AB, Canada T5J 3G2; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SRBM–					
1988	14:30308	Surface Rights Board, P.O. Box 158, Virden, MB, Canada R0M 2C0; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SRC–					
8711	14:31665	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, , Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SRD-R–					
474	14:30452	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89616980/JAW	MF-000

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SSC/TLB–					
1988	14:31970	Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, Canada K1A 0S9; $9.95 IN OTHER COUNTRIES $11.95 CAN; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
SSI–					
87-09	14:30923	NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS		DE89613825/JAW	MF-000
87-11	14:30640	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614715/JAW	MF-000
87-23	14:30924	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613826/JAW	MF-000
87-26	14:30641	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89614716/JAW	MF-000
87-29	14:30888	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613846/JAW	MF-000
87-31	14:30925	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE89613862/JAW	MF-000
88-07	14:31856	NTIS (US Sales Only), PC A06/MF A01		DE89764823/JAW	MF-000
88-16	14:30626	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613861/JAW	MF-000
88-20	14:32780	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613904/JAW	MF-000
88-21	14:30607	NTIS (US Sales Only), PC A04/MF A01		DE89764822/JAW	MF-000
STAN-CS–					
88-1231	14:32977	*See* AD-A–204463/4/XAB			
STE–					
55	14:32047	Indian and Northern Affairs Canada, Reference Centre, Les Terrasses de la Chaudier, Ottawa, ON, Canada K1A 0H4; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
STEV–					
1988-R15	14:31034	NTIS (US Sales Only), PC A10/MF A01;1		DE89766907/JAW	MF-000
1989-R1	14:30785	NTIS (US Sales Only), PC A03/MF A01;1		DE89766895/JAW	MF-000
STEV-EO–					
89-1	14:30739	NTIS (US Sales Only), PC A03/MF A01;1		DE89766887/JAW	MF-000
89-3	14:30740	NTIS (US Sales Only), PC A03/MF A01;1		DE89766888/JAW	MF-000
89-6	14:30741	NTIS (US Sales Only), PC A06/MF A01;1		DE89766926/JAW	MF-000
STEV-FBT–					
89-19	14:31584	NTIS (US Sales Only), PC A03;3		DE89766889/JAW	MF-000
89-20	14:30801	NTIS (US Sales Only), PC A06/MF A01;1		DE89766890/JAW	MF-000
STEV-FGT–					
89-1	14:30742	NTIS (US Sales Only), PC A03/MF A01;1		DE89766927/JAW	MF-000
STEV-FJV–					
89-1	14:31153	NTIS (US Sales Only), PC A06/MF A01;1		DE89766928/JAW	MF-000
STEV-NYEL–					
89-1	14:31877	NTIS (US Sales Only), PC A03/MF A01;1		DE89766924/JAW	MF-000
STEV-TB–					
89-1	14:31395	NTIS (US Sales Only), PC A03/MF A01;1		DE89766885/JAW	MF-000
89-2	14:30675	NTIS (US Sales Only), PC A03/MF A01;1		DE89766886/JAW	MF-000
STF–					
34A88072	14:30743	NTIS (US Sales Only), PC A03/MF A01		DE89766872/JAW	MF-000
45A84002	14:31131	NTIS (US Sales Only), PC A04/MF A01		DE89766877/JAW	MF-000
85037	14:31690	NTIS (US Sales Only), PC A03/MF A01		DE89766878/JAW	MF-000
STRIPA–					
88-11	14:30608	NTIS (US Sales Only), PC A09/MF A01		DE89775047/JAW	MF-000
STRIPA-TR–					
88-03	14:30609	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE89617428/JAW	MF-000
STU–					
83-4640	14:31162	NTIS (US Sales Only), PC A02/MF A01;1		DE89766904/JAW	MF-000
STU-I–					
671	14:31616	NTIS (US Sales Only), PC A08/MF A01;1		DE89766894/JAW	MF-000
STUDSVIK-NP–					
87-110	14:31987	*See* SKI–87101			
STUDSVIK-STSRX–					
1	14:30826	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012708/JAW	MF-523
2	14:30827	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012709/JAW	MF-523
3	14:30828	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012710/JAW	MF-523
4	14:30829	NTIS (US Sales Only), PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012711/JAW	MF-523
7	14:30830	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012714/JAW	MF-523
9	14:30873	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012716/JAW	MF-523
10-Rev.	14:30843	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012717/JAW	MF-523

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
11	14:30831	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012718/JAW	MF-523
12	14:30832	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012719/JAW	MF-523
13	14:30833	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012720/JAW	MF-523
14	14:30844	NTIS (US Sales Only), PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012721/JAW	MF-523
15	14:30834	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012722/JAW	MF-523
16	14:30835	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012723/JAW	MF-523
17	14:30836	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012724/JAW	MF-523
SU/EE–					
309U403	14:31132	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
SV-UL–					
1988-34	14:30759	NTIS (US Sales Only), PC A03/MF A01;1		DE89766897/JAW	MF-000
SWRI–					
8124	14:31314	*See* AD-A-204233/1/XAB			
TAU–					
8704-1	14:32422	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
TC/MCI–					
506	14:30309	Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, Canada K1A 0N5; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
TEMP–					
AF-88-02	14:31166	Transportation Energy Management Program (TEMP), Central Building, Rm. 324, Ontario Ministry of Transportation and Communications, 1201 Wilson Ave., Downsview, ON, Canada M3M 1J8; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
TR–					
0088(3940-05)-4	14:32746	*See* AD-A-204202/6/XAB			
TRB/TRR–					
1162	14:31100	*See* PB–89-160238/XAB			
1165	14:31101	*See* PB–89-160246/XAB			
1166	14:31102	*See* PB–89-160253/XAB			
1167	14:31103	*See* PB–89-160261/XAB			
TTS–					
711G624	14:30802	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
TU–					
0003	14:31465	*See* CNIC–00057			
U.OFIOWA–					
86-40	14:32442	*See* AD-A-204474/1/XAB			
UCB-NE–					
4127	14:30567	*See* LBL–25769			
UCB-PTH–					
88/20	14:32618	*See* LBL–25784			
UCB/SEMM–					
88/15	14:31618	*See* UCRL–21192			
88/16	14:31618	*See* UCRL–21192			
8817	14:31618	*See* UCRL–21192			
UCD–					
472-133	14:32394	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012234/JAW	PC-408
UCID–					
20717-Rev.1	14:31093	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012256/JAW	MF-707
21594	14:30394	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012808/JAW	MF-126

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
21622	14:33011	NTIS, PC A08/MF A01 - OSTI		DE89012246/JAW	MF-000
21631	14:31971	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013381/JAW	MF-402
21633	14:31910	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013378/JAW	MF-702
21646	14:31586	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012811/JAW	MF-706
21677	14:33024	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012810/JAW	MF-000
21681	14:32932	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012809/JAW	MF-420
21700	14:30610	NTIS, PC A07/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012806/JAW	MF-811
21701	14:33030	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013322/JAW	MF-000
21703	14:31633	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012807/JAW	MF-000
21733	14:31617	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013379/JAW	MF-406
UCRL–					
100064	14:31897	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008035/JAW	MF-741
100156	14:33012	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006739/JAW	MF-405
100168	14:32802	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006158/JAW	MF-705
100185	14:31878	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005350/JAW	MF-706
100189	14:31879	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005648/JAW	MF-000
100192	14:32840	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005662/JAW	MF-705;MN-706
100395	14:30613	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011898/JAW	MF-70
100577	14:32886	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012330/JAW	MF-420
100634	14:31771	*See* SLAC-PUB–4861			
100655	14:32973	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008121/JAW	MF-700;MN-706
100721-Rev.1	14:31976	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009261/JAW	MF-402
100789	14:33031	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012287/JAW	MF-000
100817	14:31912	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012291/JAW	MF-402
100825	14:32681	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012295/JAW	MF-700
100861	14:31678	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012302/JAW	MF-506
100878	14:31094	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012369/JAW	MF-702
100879	14:32529	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010242/JAW	MF-405
100880	14:32530	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010241/JAW	MF-405
100883	14:32841	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012286/JAW	MF-700
100910	14:31783	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012299/JAW	MF-712
100911	14:31784	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012293/JAW	MF-000
100998	14:32740	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012298/JAW	MF-411
101001	14:32842	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013262/JAW	MF-700
101060	14:33013	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012370/JAW	MF-705
101121	14:32464	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012936/JAW	MF-700
21003	14:31911	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012605/JAW	MF-702
21060-87-2	14:30611	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013174/JAW	MF-814
21086-Vol.1	14:31904	NTIS, PC A13/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012557/JAW	MF-702
21192	14:31618	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012322/JAW	MF-706
21201	14:31337	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012326/JAW	MF-704
21203	14:31634	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012624/JAW	MF-706
21205	14:31172	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012604/JAW	MF-700
52000-89-2-3	14:32508	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012251/JAW	PC-700
53615-87	14:30612	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013344/JAW	PC-702
53689-88	14:30990	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012801/JAW	PC-700
53924	14:31622	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012795/JAW	PC-706
53925	14:31677	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012796/JAW	PC-403
97838	14:32839	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013188/JAW	MF-705
98720	14:32423	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011406/JAW	MF-403
98769	14:32463	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012934/JAW	MF-700
98803	14:31782	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89005348/JAW	MF-706
98804	14:31623	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006747/JAW	MF-000
99499	14:32754	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011897/JAW	MF-705
99593	14:31729	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012932/JAW	MF-000
99662	14:32435	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89006736/JAW	MF-700
99869	14:31707	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012968/JAW	MF-712
99883	14:31972	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011893/JAW	MF-402
99926	14:31973	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009964/JAW	MF-603
99927	14:31974	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010238/JAW	MF-000
99928	14:31975	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89010239/JAW	MF-702
UM-HE–					
89-11	14:32462	*See* SAND–89-1234C			
UNC/GJ–					
44(TMC)	14:30705	*See* DOE/ID/12584–29			
47(TMC)	14:31063	*See* DOE/ID/12584–38			
48(TMC)	14:30627	*See* DOE/ID/12584–39			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
UNC/GJ-TMC–					
5	14:31064	*See* DOE/ID/12584–43			
USAFOEHL–					
88-149EQ0686MEF	14:31988	*See* AD-A–204505/2/XAB			
UT–					
9013434	14:30278	OSTI - University of Texas at Austin, Bureau of Economic Geology, University Station, Box X, Austin, TX 78713		TI89013434/JAW	MF-000
UTSI–					
89-01	14:31041	*See* DOE/ET/10815–127			
UnB-FIS–					
08/88	14:32803	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89615478/JAW	MF-000
09/88	14:31230	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89613257/JAW	MF-000
10/88	14:32804	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE89612214/JAW	MF-000
11/88	14:31231	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE89613258/JAW	MF-000
VI–					
422USOA	14:31133	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, Canada H3Z 2P9; $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.			ND-000
WHC-EP–					
0182-12	14:30614	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013158/JAW	MF-721
0195	14:30615	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012948/JAW	MF-721
WHC-SA–					
0204	14:30926	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011856/JAW	MF-530
WIC–					
1988	14:31338	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
RC262/4/88	14:31232	Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, Canada K1A 0G1; $N/C; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1; $10 CAN.			ND-000
WSRC-RP–					
89-12	14:30616	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011624/JAW	MF-721

Order Number Correlation

The correlation list is provided for those organizations that file documents by report number but may receive requests by order number. For more information about a document, refer to the Report Number Index.

Order No.	*Report No.*
DE89000614	CONF-890630–1
DE89000730	DOE/BC–88/3
DE89000743	NIPER–390
DE89000745	NIPER–385
DE89000746	NIPER–323
DE89000747	NIPER–264
DE89000748	NIPER–319
DE89000749	NIPER–395
DE89000803	DOE/CH/10093–31
DE89000842	SERI/TP–254-3453
DE89000850	SERI/TP–254-3049
DE89000851	SERI/SP–220-3458
DE89000857	DOE/CH/10093–42
DE89000868	SAND–89-0298
DE89000869	DOE/CH/10093–54
DE89000875	SERI/TP–254-3478
DE89000883	SERI/SP–211-3488
DE89000888	SERI/STR–217-3476
DE89000896	SERI/TR–213-3472
DE89000898	SERI/PR–211-3483
DE89000909	DOE/LC/11062–2660
DE89000920	DOE/MC/23126–2644
DE89000926	DOE/MC/24261–2672
DE89000941	DOE/MC/24267–2664
DE89000945	DOE/MC/23087–2667
DE89000954	DOE/MC/23167–2678-Vol.2
DE89000959	DOE/MC/11076–2687
DE89000960	DOE/MC/11076–2688
DE89000962	DOE/MC/11076–2690
DE89000964	DOE/MC/11076–2684
DE89000968	DOE/MC/20422–2677
DE89001049	CONF-890631–1
DE89003912	SAND–88-3027C
DE89005048	DOE/ER/60336–5
DE89005129	CONF-890657–1
DE89005207	SAND–88-2734C
DE89005209	SAND–88-3388C
DE89005346	SAND–88-3389C
DE89005348	UCRL–98803
DE89005350	UCRL–100185
DE89005394	DOE/OSTI–3406-Suppl.1-Add.2
DE89005459	LA-UR–88-4130
DE89005597	SAND–88-3410C
DE89005607	SAND–88-2650C
DE89005648	UCRL–100189
DE89005662	UCRL–100192
DE89005777	SAND–88-2535C
DE89005804	CONF-890662–1
DE89005917	SAND–88-7169C
DE89005919	SAND–88-2943C
DE89006158	UCRL–100168
DE89006328	SAND–88-2115C
DE89006427	CONF-890676–1
DE89006634	CONF-890604–1
DE89006724	SAND–88-2744C
DE89006736	UCRL–99662
DE89006739	UCRL–100156
DE89006747	UCRL–98804
DE89006760	DP-MS–89-11
DE89006769	SAND–89-7052C
DE89007036	SAND–88-2230C
DE89007085	SAND–89-0157C
DE89007086	SAND–89-0411C
DE89007145	SAND–88-1296C
DE89007233	DP-MS–88-235
DE89007559	DOE/ER/13083–T3
DE89007639	SAND–89-0424C
DE89008035	UCRL–100064
DE89008121	UCRL–100655
DE89008184	DOE/PC/70809–T15
DE89008196	SAND–89-0264C
DE89008236	CONF-890692–1
DE89008741	CONF-890657–2
DE89008816	ORNL/tr–89/7
DE89009049	DOE/PC/81201–T10
DE89009058	LBL–26595
DE89009069	SAND–89-0676C
DE89009081	DOE/PC/81582–T1
DE89009261	UCRL–100721-Rev.1
DE89009273	LA-UR–89-956
DE89009323	SAND–88-1112C
DE89009327	SAND–89-0188C
DE89009376	LA-UR–89-1059
DE89009407	LA-UR–89-760
DE89009833	SAND–88-2287C
DE89009945	SAND–89-0301C
DE89009964	UCRL–99926
DE89009978	SAND–89-0909C
DE89010238	UCRL–99927
DE89010239	UCRL–99928
DE89010241	UCRL–100880
DE89010242	UCRL–100879
DE89010250	BNL–42416
DE89010319	CONF-890692–5
DE89010329	SAND–89-0953C
DE89010369	CONF-890277–1
DE89010372	CONF-8905121–1
DE89010387	LBL–25424
DE89010426	RFP–4329
DE89010427	RFP–4330
DE89010432	LBL–26890
DE89010435	SAND–88-2521C
DE89010437	SAND–88-2098C
DE89010450	DP-MS–88-251
DE89010457	DP-MS–88-213
DE89010459	DP-MS–89-5
DE89010463	DP-MS–89-4
DE89010538	SAND–89-0463
DE89010743	SAND–89-0267C
DE89010769	SAND–89-0861C
DE89010861	SAND–89-1085C
DE89010863	SAND–89-0337C
DE89010864	SAND–89-1263C
DE89010976	EGG-M–88355
DE89011066	SAND–89-0486C
DE89011126	EGG-M–89013
DE89011134	EGG-M–88231
DE89011148	K/CSD/INF–88/20
DE89011160	EGG-M–88480
DE89011190	LA-UR–89-1207
DE89011208	PNL-SA–16186
DE89011221	CONF-8704380–1
DE89011233	CONF-890692–6
DE89011279	SLAC-PUB–4821
DE89011282	SLAC-PUB–4894
DE89011289	NVO–314
DE89011297	SAND–89-0512
DE89011355	PNL–6883
DE89011356	LA–11579-C
DE89011394	SAND–89-1257C
DE89011401	LA–11543-C
DE89011406	UCRL–98720
DE89011411	DOE/ER/40224–64
DE89011528	CONF-8707194–Summs.
DE89011529	CONF-8607379–Summs.
DE89011549	CONF-880514–Absts.
DE89011569	CONF-890426–10
DE89011575	CONF-8905135–1
DE89011587	DOE/FTR–9011587
DE89011603	RISO-FGP-R–14-Rev.
DE89011605	RISO-FGP-R–16
DE89011613	CONF-890634–1
DE89011624	WSRC-RP–89-12
DE89011627	DP-MS–88-218
DE89011771	LBL–25784
DE89011773	LBL–25317
DE89011788	K/ITP–269/P1
DE89011790	K/ITP–269/P3
DE89011791	K/ITP–269/P4
DE89011800	PATENTS-US–A7155451
DE89011808	PATENTS-US–A7212545
DE89011820	LBL–26898
DE89011823	LBL–27019
DE89011827	DOE/CE/15323–T5
DE89011830	DOE/ER/60255–5
DE89011836	PNL-SA–16869
DE89011837	PNL-SA–15956
DE89011839	DOE/NV/10384–32
DE89011840	SAND–89-1234C
DE89011844	SAND–89-1101C
DE89011846	LA–11596-MS
DE89011850	SAND–88-2741C
DE89011851	HEDL-SA–3698
DE89011853	PNL–6450-18-HEDR
DE89011855	HEDL-SA–3713
DE89011856	WHC-SA–0204
DE89011873	ORNL/Sub–86-95900/01
DE89011877	BNL–42535
DE89011879	SAND–89-1222C
DE89011882	SAND–89-1194C
DE89011884	SAND–89-0938C
DE89011885	SAND–89-0923C
DE89011886	SAND–88-3465C
DE89011893	UCRL–99883
DE89011897	UCRL–99499
DE89011898	UCRL–100395
DE89011902	BNL–42663
DE89012113	INIS-SU–74/A
DE89012114	INIS-SU–80
DE89012115	INIS-SU–78
DE89012116	ESA-SP–281
DE89012218	BNL–42502

Order No.	Report No.
DE89012219	PNL–6824
DE89012220	PNL–6815
DE89012223	BNL–41390
DE89012226	BNL–42275
DE89012227	DOE/ER/40150–68-Rev.
DE89012228	BNL–42564
DE89012230	DOE/ET/25108–T1
DE89012232	DOE/FE–0129
DE89012234	UCD–472-133
DE89012235	ORNL/M–551/R1
DE89012236	PNL–6877
DE89012240	DOE/ID/12584–39
DE89012243	DOE/EH–0088
DE89012245	ANL/TM–466
DE89012246	UCID–21622
DE89012247	SAND–89-0489
DE89012251	UCRL–52000-89-2-3
DE89012252	DOE/EH–0073
DE89012254	DOE/CH/10093–53
DE89012255	SAND–88-0173
DE89012256	UCID–20717-Rev.1
DE89012257	ORNL/Sub–89-21242/1
DE89012258	SAND–88-3341
DE89012259	LA–10773-Add.
DE89012260	LA–11419-MS
DE89012261	LA–11538-MS
DE89012262	DOE/ID/12584–29
DE89012263	SLAC-PUB–4975
DE89012264	SLAC-PUB–4967
DE89012265	SLAC-PUB–4966
DE89012266	SLAC-PUB–4965
DE89012267	SLAC-PUB–4956
DE89012268	SLAC-PUB–4940
DE89012269	SLAC-PUB–4934
DE89012270	SLAC-PUB–4933
DE89012271	SLAC-PUB–4925
DE89012272	SLAC-PUB–4924
DE89012273	SLAC-PUB–4922
DE89012274	SLAC-PUB–4921
DE89012275	SLAC-PUB–4914
DE89012276	SLAC-PUB–4913
DE89012277	SLAC-PUB–4906
DE89012278	SLAC-PUB–4905
DE89012279	SLAC-PUB–4902
DE89012280	SLAC-PUB–4898
DE89012281	SLAC-PUB–4883
DE89012282	ORNL/M–775
DE89012286	UCRL–100883
DE89012287	UCRL–100789
DE89012291	UCRL–100817
DE89012293	UCRL–100911
DE89012295	UCRL–100825
DE89012298	UCRL–100998
DE89012299	UCRL–100910
DE89012302	UCRL–100861
DE89012305	DOE/PC/88883–T2
DE89012306	DOE/PC/88874–T3
DE89012322	UCRL–21192
DE89012326	UCRL–21201
DE89012330	UCRL–100577
DE89012337	CONF-890403–19
DE89012340	DOE/ER/60517–3
DE89012343	CONF-880613–31
DE89012345	CONF-8906113–1
DE89012350	CONF-8906113–2
DE89012351	CONF-890509–1
DE89012359	CONF-890692–9
DE89012362	CONF-8905120–10
DE89012365	ORNL/M–829
DE89012369	UCRL–100878
DE89012370	UCRL–101060
DE89012371	FNAL/C–89/89
DE89012372	FNAL/C–89/70
DE89012374	DOE/ER/13729–1
DE89012375	DOE/ER/13912–1
DE89012376	DOE/WP/16151–3
DE89012377	DOE/SR/15191–2
DE89012378	ANL–9012378
DE89012383	CONF-8904210–1
DE89012384	CONF-890207–30
DE89012392	CONF-851069–1
DE89012394	CONF-890406–17
DE89012396	CONF-890165–3
DE89012398	CONF-890425–3
DE89012400	DOE/CE/26561–T1
DE89012403	DOE/ER/40465–T1
DE89012404	DOE/CE/63522–T1
DE89012407	CONF-881155–73
DE89012408	LA-UR–89-1575
DE89012415	CONF-8905121–2
DE89012416	CONF-890426–12
DE89012417	CONF-8904197–2
DE89012419	CONF-8905118–9
DE89012421	CONF-8905118–8
DE89012425	CONF-881031–70
DE89012426	CONF-890108–1
DE89012477	DOE/FTR–9012477
DE89012481	DOE/PC/81012–T1-Pt.2
DE89012489	DOE/BC/14304–T1
DE89012492	DOE/SR/18001–2
DE89012493	CONF-8905142–1-Vugraphs
DE89012497	SAND–88-2813C
DE89012499	ORNL/tr–89/10
DE89012500	CONF-8905141–1
DE89012506	CONF-890631–18
DE89012508	CONF-890693–2
DE89012511	CONF-890207–31
DE89012518	DOE/ER/13782–3
DE89012545	BNL-NUREG–42595
DE89012546	BNL-NUREG–42259
DE89012554	BNL–42334
DE89012557	UCRL–21086-Vol.1
DE89012559	SAND–89-0178
DE89012561	DOE/EIA–0455(87)
DE89012562	DOE/EIA–0202(89/2Q)
DE89012563	DOE/EIA–0524
DE89012564	DOE/MA–0372
DE89012568	SAND–89-0095C
DE89012569	SAND–88-2627C
DE89012571	SAND–89-1223C
DE89012572	SAND–88-2826C
DE89012580	BNL–42537
DE89012583	PNL–6862
DE89012585	DOE/PC/88930–T2
DE89012588	DOE/PC/91024–T10
DE89012589	LBL–27094
DE89012593	LA-UR–89-1511
DE89012594	LA-UR–89-1507
DE89012595	LA-UR–89-1503
DE89012596	LA-UR–89-1497
DE89012597	LA-UR–89-1471
DE89012604	UCRL–21205
DE89012605	UCRL–21003
DE89012606	LA–11612-MS
DE89012609	LA-UR–89-1550
DE89012615	LA-UR–89-1607
DE89012617	LA-UR–89-1604
DE89012618	LA-UR–89-1600
DE89012619	LA-UR–89-1599
DE89012624	UCRL–21203
DE89012625	PNL–6866
DE89012627	LBL–26244
DE89012630	LBL–25961
DE89012640	SAND–89-0921C
DE89012641	SAND–89-0807C
DE89012642	SAND–89-0922C
DE89012651	DOE/PC/79818–T1
DE89012655	SAND–89-0962C
DE89012656	SAND–88-2823C
DE89012657	SAND–88-3356C
DE89012659	SAND–89-0915C
DE89012660	SAND–89-1213C
DE89012672	BNL–42683
DE89012673	BNL–42688
DE89012674	BNL–42715
DE89012680	DOE/ER/13599–T1
DE89012689	CONF-8709217–5
DE89012695	DOE/PC/88861–T16
DE89012701	DOE/ER/40235–T5
DE89012704	DOE/PC/80522–T7
DE89012708	STUDSVIK-STSRX–1
DE89012709	STUDSVIK-STSRX–2
DE89012710	STUDSVIK-STSRX–3
DE89012711	STUDSVIK-STSRX–4
DE89012714	STUDSVIK-STSRX–7
DE89012716	STUDSVIK-STSRX–9
DE89012717	STUDSVIK-STSRX–10-Rev.
DE89012718	STUDSVIK-STSRX–11
DE89012719	STUDSVIK-STSRX–12
DE89012720	STUDSVIK-STSRX–13
DE89012721	STUDSVIK-STSRX–14
DE89012722	STUDSVIK-STSRX–15
DE89012723	STUDSVIK-STSRX–16
DE89012724	STUDSVIK-STSRX–17
DE89012726	DOE/ER/45310–18
DE89012728	LBL–25951
DE89012733	LA-UR–89-1748
DE89012734	K/D–5694
DE89012735	DOE/ER/13745–2
DE89012737	LBL–26585
DE89012738	K/ITP–237
DE89012739	ORNL/RASA–88/29
DE89012743	LBL–25984
DE89012756	ORNL/RASA–89/2
DE89012761	DOE/FTR–9012800
DE89012763	EPRI-CS/EL–4415-Vol.6
DE89012764	DOE/ER/45359–1
DE89012766	LBL–27092
DE89012768	LBL–27123
DE89012769	LBL–27011
DE89012770	LA-UR–89-1574
DE89012771	FMPC/Sub–014
DE89012778	DOE/MC/21136–20
DE89012779	DOE/ER/45298–2
DE89012781	SLAC-PUB–4872
DE89012782	SLAC-PUB–4867
DE89012783	SLAC-PUB–4866
DE89012784	SLAC-PUB–4865
DE89012785	SLAC-PUB–4861
DE89012786	SLAC-PUB–4857
DE89012787	SLAC-PUB–4851
DE89012788	SLAC-PUB–4850
DE89012789	SLAC-PUB–4849
DE89012790	SLAC-PUB–4835
DE89012791	SLAC-PUB–4743
DE89012792	SLAC-PUB–4719-Rev.
DE89012793	BNL–52165
DE89012794	SAND–88-3118
DE89012795	UCRL–53924
DE89012796	UCRL–53925
DE89012797	ORNL/M–329/R1
DE89012798	LA–11561-MS
DE89012799	SAND–88-2057
DE89012800	ORNL/CON–279
DE89012801	UCRL–53689-88
DE89012802	SAND–88-1156

Order No.	Report No.
DE89012803	LA–11519-MS
DE89012804	LA–11557-MS
DE89012805	LA–11560-MS
DE89012806	UCID–21700
DE89012807	UCID–21703
DE89012808	UCID–21594
DE89012809	UCID–21681
DE89012810	UCID–21677
DE89012811	UCID–21646
DE89012813	SAND–89-0671
DE89012814	SAND–89-8228
DE89012815	SAND–88-3016
DE89012816	SAND–89-8235
DE89012817	ORNL/TM–11135
DE89012819	ORNL/TM–10735
DE89012820	CONF-8811202–
DE89012821	PNL–6884
DE89012822	PNL–6849
DE89012823	SAND–89-0593
DE89012824	MLM–3586
DE89012826	LA–11573-MS
DE89012827	SLAC–342
DE89012828	PPPL–2620
DE89012829	PPPL–2617
DE89012830	PPPL–2612
DE89012888	ORNL/M–755
DE89012896	SAND–89-0242
DE89012900	ORNL–6492
DE89012901	ORNL/CSD/TM–251
DE89012903	ORNL–6404
DE89012905	ORNL–6529
DE89012906	ORNL/TM–10919
DE89012907	CONF-8809314–
DE89012911	ORNL/CDIAC–26
DE89012912	ORNL/TM–11068
DE89012914	PPPL–2609
DE89012919	CONF-881282–
DE89012920	ORNL/TM–11079
DE89012921	DOE/EH–0089
DE89012923	ORNL–6544
DE89012925	ORNL/CON–278
DE89012926	SAND–87-0754
DE89012929	ORNL–6521
DE89012930	ANL/EES-TM–371
DE89012931	ORNL/TM–11081
DE89012932	UCRL–99593
DE89012934	UCRL–98769
DE89012936	UCRL–101121
DE89012944	DOE/ER/53252–13
DE89012947	SAND–86-2357
DE89012948	WHC-EP–0195
DE89012949	DOE/ER/13569–3
DE89012951	DOE/ER/45255–3
DE89012952	DOE/ER/53207–4
DE89012954	DOE/ER/45211–13
DE89012956	DOE/OR/21389–16
DE89012957	DOE/OR/21389–17
DE89012958	DOE/NV/10461–T1-Vol.1
DE89012961	NRL-MR–6453
DE89012968	UCRL–99869
DE89012969	CONF-890403–22
DE89012970	CONF-890403–23
DE89013030	DOE/ER/13183–3
DE89013037	DOE/RL–88-30-Vol.1
DE89013038	DOE/RL–88-30-Vol.2
DE89013039	DOE/BP/22493–4
DE89013040	DOE/BP/13795–20
DE89013041	CONF-890379–3
DE89013042	CONF-890379–4
DE89013044	CONF-890692–12
DE89013048	CONF-890403–24
DE89013055	CONF-890560–1
DE89013068	SAND–89-0031C
DE89013069	SAND–89-0503C
DE89013071	SAND–89-0070C
DE89013072	SAND–89-0020C
DE89013073	SAND–88-3399C
DE89013075	SAND–89-0069C
DE89013079	DOE/BP/39166–3
DE89013081	DOE/BP/39166–2
DE89013082	PNL–6450-19-HEDR
DE89013084	FNAL/C–89/94
DE89013085	FNAL/C–89/103
DE89013086	FNAL/C–89/109
DE89013093	DOE/BP/60288–2-Vol.1
DE89013102	K/DSRD–96
DE89013113	DOE/ER/02271–112
DE89013117	DOE/ET/10815–127
DE89013118	DOE/ER/40372–02
DE89013121	PPPL–2622
DE89013122	DOE/BC/14152–2
DE89013123	DOE/PC/70018–22
DE89013124	DOE/ER/40306–1
DE89013125	DOE/PC/70018–27
DE89013126	DOE/PC/70018–37
DE89013127	DOE/PC/70018–40
DE89013128	DOE/PC/70018–59
DE89013129	DOE/PC/70018–60
DE89013130	DOE/PC/70018–62
DE89013131	DOE/PC/70018–65
DE89013132	HW–23642
DE89013133	HW–36819
DE89013139	CONF-860911–33
DE89013141	SAND–88-3153
DE89013157	ILL–9013157
DE89013158	WHC-EP–0182-12
DE89013166	SAND–89-1224C
DE89013170	LBL–25986
DE89013172	CONF-890521–10
DE89013174	UCRL–21060-87-2
DE89013175	LA–11575-T
DE89013177	CONF-881155–74
DE89013181	CONF-881245–2
DE89013182	DOE/ER/45269–3
DE89013183	CONF-881174–4
DE89013184	CONF-8810182–30
DE89013185	CONF-8810290–2
DE89013188	UCRL–97838
DE89013189	LBL–25953
DE89013190	LBL–27063
DE89013196	CONF-8904203–2
DE89013197	DOE/ER/13717–1
DE89013198	DOE/ER/13526–1
DE89013199	RIVM–00-06
DE89013205	DOE/NV/10322–25
DE89013206	LA-UR–89-1573
DE89013207	LA-UR–89-1572
DE89013208	LA-UR–89-1571
DE89013211	BNL–34518
DE89013212	BNL–42277
DE89013225	DOE/ET/53082–1
DE89013257	DOE/FTR–9013257
DE89013262	UCRL–101001
DE89013264	LA-UR–89-1832
DE89013266	DOE/ER/45311–2
DE89013273	ANL-HEP-CP–88-84
DE89013276	ANL-HEP-CP–89-33
DE89013277	CONF-890406–18
DE89013280	CONF-890488–8
DE89013285	CONF-890335–171
DE89013287	CONF-890624–1
DE89013299	CONF-890426–11
DE89013300	CONF-890517–1
DE89013302	CONF-890692–11
DE89013303	CONF-890335–172
DE89013305	CONF-890335–170
DE89013307	GA-A–19663
DE89013308	GA-A–19662
DE89013309	CONF-881079–2
DE89013311	CONF-880602–5
DE89013314	DOE/ET/53088–369
DE89013315	DOE/ET/53088–372
DE89013316	SLAC–341
DE89013320	PPPL–2619
DE89013321	ORNL/TM–11160
DE89013322	UCID–21701
DE89013328	DOE/ID–12114
DE89013329	SAND–89-0842
DE89013330	SAND–88-7042
DE89013331	SAND–89-0341
DE89013333	SAND–88-7036-Pt.2
DE89013334	LA–11506-PR
DE89013335	ORNL/TM–11143
DE89013336	ORNL/TM–11199
DE89013339	DOE/ID/12584–38
DE89013340	PNL–6800-Pt.3
DE89013341	PNL–6885
DE89013342	PNL–6699
DE89013343	KCP–613-4101
DE89013344	UCRL–53615-87
DE89013345	DOE/ID/12584–43
DE89013346	SAND–88-7036-Pt.1
DE89013348	SAND–88-2907
DE89013349	PPPL–2624
DE89013350	PPPL–2621
DE89013352	LBL–27219
DE89013353	LBL–26220
DE89013354	LBL–25586
DE89013355	LBL–26584
DE89013357	LBL–26587
DE89013359	LBL–25610
DE89013360	LBL–25611
DE89013361	LBL–25558
DE89013364	LBL–25348-Rev.
DE89013366	LBL–24212
DE89013367	LBL–25769
DE89013378	UCID–21633
DE89013379	UCID–21733
DE89013381	UCID–21631
DE89013420	LBL–27014
DE89013421	LBL–27093
DE89013423	LBL–26868
DE89013427	LBL–27059
DE89013428	LBL–26282
DE89013429	LBL–26247
DE89013431	LBL–25735
DE89013432	LBL–27062
DE89013435	LA-UR–89-1747
DE89013439	LA-UR–89-1722
DE89013442	LA-UR–89-1693
DE89013443	LA-UR–89-1685
DE89013444	LA-UR–89-1684
DE89013446	LA-UR–89-1576
DE89013447	SAND–89-0937C
DE89013455	LA-UR–89-1793
DE89013457	LA-UR–89-1788
DE89013461	LA-UR–89-1760
DE89013467	LA-UR–89-1852
DE89013469	LA-UR–89-1838
DE89013471	DPST–89-359
DE89013472	DPST–88-324-Rev.1
DE89013480	DPST–87-474
DE89013481	DPST–87-636
DE89013499	DPST–89-319
DE89013502	DOE/ER/10353–T3
DE89013503	DOE/ER/10353–T2

Order No.	Report No.
DE89013504	DOE/ER/10353–T1
DE89013570	DOE/ER/13933–1
DE89013574	CONF-890435–3
DE89013578	DOE/ER/40467–2
DE89013581	SAND–89-0808C
DE89013583	SAND–89-0914C
DE89013585	SAND–88-2342C
DE89013589	SAND–89-0935C
DE89013590	SAND–89-0559C
DE89013591	SAND–89-0560C
DE89013594	SAND–88-2341C
DE89013595	SAND–88-2778C
DE89013596	GRI–88/0319
DE89013599	DOE/ER/45063–4
DE89013600	DOE/ER/13612–1
DE89013601	DOE/ER/60664–1
DE89013602	SAND–89-0608C
DE89013603	DOE/ER/02220–1
DE89013605	DOE/ER/60546–4
DE89013610	DOE/FTR–9013610
DE89013611	HEHF–54-88
DE89013613	DOE/FTR–9013613
DE89013614	DOE/ER/40063–13
DE89013615	CONF-8905127–4
DE89013620	CONF-8904219–1
DE89013621	CONF-890402–6
DE89013622	CONF-890406–19
DE89013623	CONF-890306–4
DE89013624	CONF-8810182–28
DE89013625	CONF-870430–17
DE89013628	CONF-8905105–2
DE89013630	CONF-890124–4
DE89013631	CONF-8809223–7
DE89013640	CONF-890309–1
DE89013641	CONF-8811147–3
DE89013642	CONF-890177–2
DE89013653	ANL-HEP-CP–89-12
DE89013655	LA–11588-MS
DE89013657	ORNL/TM–10921
DE89013667	DOE/PC/89904–T2
DE89013689	LBL–27196
DE89609811	ENEA-RT-FUS–88-11
DE89610045	INIS-mf–11415
DE89611893	IC–88/377
DE89611970	INFN-AE–88-13
DE89612009	IFT-TD–11/87
DE89612010	INFN-AE–88-12
DE89612194	INIS-BR–1483
DE89612209	INIS-BR–1511
DE89612210	INIS-BR–1520
DE89612214	UnB-FIS–10/88
DE89612371	ACIESP–60(v.3)
DE89612427	ENEA-RT-FUS–88-10
DE89612438	CNIC–00160
DE89612648	LUNFD6-TFME–1017-1-11-1988
DE89612741	BARC–1427
DE89612747	RAL–89-004
DE89612754	INIS-BR–1505
DE89612846	IC–88/375
DE89613006	LUTHD2-TFKF–1010-1-103-1988
DE89613030	INDC(CCP)–292/L
DE89613037	INDC(CCP)–293/L
DE89613040	INDC(CCP)–295/L
DE89613058	BARC–1437
DE89613060	CBPF-NF–041/88
DE89613065	INIS-BR–1501
DE89613067	INIS-BR–1503
DE89613068	INIS-BR–1514
DE89613070	IPEN-PUB–230
DE89613071	IPEN-PUB–231
DE89613114	IEN-DQUI-DIQUI–03/80
DE89613115	INIS-BR–1453
DE89613116	INIS-BR–1454
DE89613120	SKB-TR–88-21
DE89613205	IEN-DQUI-DIQUI–04/80
DE89613223	INIS-BR–1532
DE89613247	INIS-BR–1464
DE89613257	UnB-FIS–09/88
DE89613258	UnB-FIS–11/88
DE89613286	INIS-BR–1459
DE89613287	INIS-BR–1460
DE89613288	INIS-BR–1461
DE89613289	INIS-BR–1463
DE89613290	INIS-BR–1466
DE89613291	INIS-BR–1521
DE89613340	IPEN-PUB–232
DE89613395	INIS-BR–1531
DE89613396	INIS-BR–1533
DE89613397	INIS-BR–1507
DE89613464	CNIC–00175
DE89613483	INIS-BR–1504
DE89613512	BARC–1429
DE89613513	IC–88/423
DE89613520	SKB-TR–88-23
DE89613557	SKI–87101
DE89613581	IRF-TR–34
DE89613582	RAL–89-002
DE89613737	INIS-BR–1486
DE89613791	INIS-BR–1485
DE89613792	LUMEDW-MEKN–1004-1-139-1986
DE89613806	OEVS-Mitteilung–1988
DE89613823	NEI-SE–38
DE89613825	SSI–87-09
DE89613826	SSI–87-23
DE89613838	SNV–3463
DE89613840	INIS-BR–1484
DE89613841	IPEN-PUB–233
DE89613842	SNV–3462
DE89613846	SSI–87-29
DE89613861	SSI–88-16
DE89613862	SSI–87-31
DE89613901	SNV–3399
DE89613904	SSI–88-20
DE89613927	INIS-BR–1516
DE89614199	INIS-mf–11424
DE89614215	INIS-BR–1509
DE89614270	IYaF–88-80
DE89614290	IYaF–88-41
DE89614319	LUNTDX-NTMX–7008-1-12-1988
DE89614320	NIKHEF-K-LINO–151
DE89614329	CNIC–00088
DE89614330	CTA-EAv-ENU-FR–002/81
DE89614331	CTA-EAv-IS–007/80
DE89614332	CTA-IEAv-ENU-FR–016/82
DE89614333	CTA-IEAv-RI–006/83
DE89614334	CTA-IEAv-RP–019/88
DE89614336	LUTFD2-TFRT–5371-1-76-1987
DE89614346	ENEA-RT-PAS–88-25
DE89614347	INIS-BR–1462
DE89614348	INIS-BR–1467
DE89614403	PSI–25
DE89614410	CTA-IEAv-NT–009/88
DE89614411	INIS-BR–1465
DE89614481	CTA-IEAv-RP–023-88
DE89614482	INIS-BR–1510
DE89614491	NUCLEBRAS-CDTN–603
DE89614587	INFN-LNF–88-45(P)
DE89614619	CNIC–00130
DE89614653	DOE-RW–88.100
DE89614654	DOE-RW–88.106
DE89614664	INIS-GB–188
DE89614665	INIS-mf–11422
DE89614667	SKB-JSSP-TR–88-01
DE89614683	INIS-BR–1477
DE89614715	SSI–87-11
DE89614716	SSI–87-26
DE89614718	IEN-DEMA–003/80
DE89614722	CTA-EAv-IS–001/80
DE89614723	CNIC–00057
DE89614724	CTA-EAv-ENU-FR–001/81
DE89614725	CTA-IEAv-NI-CPD-SC–014/82
DE89614726	CTA-IEAv-NI-ENU–001/83
DE89614727	CTA-IEAv-NT–007/88
DE89614728	CTA-IEAv-RI–003/83
DE89614729	CTA-IEAv-RP–024/88
DE89614730	CTA-IEAV-RP–065/88
DE89614731	INIS-BR–1513
DE89614733	IYaF–88-81
DE89614750	INIS-mf–11426
DE89615344	IYaF–88-45
DE89615345	IYaF–88-47
DE89615361	IYaF–88-35
DE89615386	ITF–87-166
DE89615387	ITP–87-154
DE89615388	KIFVE–88-07
DE89615389	KIYI–88-35
DE89615405	ITP–87-140
DE89615411	ANU-P–999
DE89615449	ANU-P–1002
DE89615450	INIS-BR–1530
DE89615451	KIYI–88-22
DE89615478	UnB-FIS–08/88
DE89615481	KIFVE–88-10
DE89615525	INIS-mf–4754(no.38)
DE89615526	IYaF–88-92
DE89615530	IYaF–88-52
DE89615531	IYaF–88-86
DE89615532	KIYI–88-32
DE89615574	KIYI–88-6
DE89615577	KIYI–88-31
DE89615584	CTH-IEFT-PP–1987-19
DE89615590	ECN–214
DE89615593	IYaF–88-74
DE89615598	IYaF–88-14
DE89615599	IYaF–88-7
DE89615601	IYaF–88-76
DE89615604	INIS-GB–186
DE89615712	HEPI–88-05
DE89615713	ITP–87-167
DE89615721	ITP–87-145
DE89615722	ITP–88-9
DE89615723	RAL–89-011
DE89615743	RAL–89-013
DE89615756	INIS-mf–11429
DE89615757	INIS-mf–11432
DE89615774	ANU-P–995
DE89615775	INDC(BZL)–030/LJ
DE89615776	INDC(CSR)–015/LJ
DE89615778	INIS-mf–11434
DE89615779	INIS-mf–11436
DE89615780	INIS-mf–11437
DE89615782	INIS-mf–11439
DE89615786	ITP–87-148
DE89615787	ITP–88-2
DE89615788	KIYI–88-18
DE89615813	ANU-P–984
DE89615814	INIS-mf–11433
DE89615818	INDC(CCP)–290/LJ
DE89615819	LAFI–127
DE89615823	KIYI–88-10
DE89615826	ANU-P–1007

Order No.	Report No.
DE89615827	ANU-P–981
DE89615828	KIYI–88-4
DE89615833	ANU-P–969
DE89615835	ANU-P–1000
DE89615836	ANU-P–983
DE89615837	ANU-P–990
DE89615841	INIS-BR–1515
DE89615865	INIS-BR–1487
DE89615964	RI–202
DE89615984	LHRL-LIB/Trans–4
DE89616019	ANU-P–965
DE89616020	INIS-BR–1443
DE89616060	INIS-BR–1529
DE89616080	ANSTO/E–676
DE89616100	NSS/R–126
DE89616201	FOA-C–20679-9.2
DE89616231	ANSTO/E–674
DE89616243	BARC–1420
DE89616248	ANSTO/E–680
DE89616249	DOE-RW–88.109
DE89616250	NSS/R–132
DE89616547	INIS-mf–11435
DE89616596	ANSTO/E–677
DE89616597	SAAS–365
DE89616599	ANSTO/E–663
DE89616600	INIS-mf–11447
DE89616624	SNV–3447
DE89616630	CNEN-NE–5-03
DE89616685	CCHEN–1
DE89616686	IAEA-R–4535/F
DE89616705	SAAS–370
DE89616941	ANSTO/E–679
DE89616948	SAAS–367
DE89616963	BARC–1424
DE89616979	DOE-RW–88.067
DE89616980	SRD-R–474
DE89616996	ANU-P–992
DE89616999	IFVE-OUNK–88-55
DE89617000	IYaF–88-25
DE89617002	IYaF–88-16
DE89617003	IYaF–88-21
DE89617006	FEI–1887
DE89617007	IFVE-ORI–88-85
DE89617012	IFVE-OEA–88-73
DE89617014	JINR–9-88-356
DE89617015	KIYI–88-26
DE89617016	IFVE-OUNK–88-15
DE89617073	INIS-mf–11430
DE89617074	INIS-mf–11431
DE89617197	ITEF–16(1988)
DE89617333	ANU-P–978
DE89617335	KIYI–88-29
DE89617336	KIYI–88-30
DE89617337	KIYI–88-40
DE89617338	KIYI–88-8
DE89617349	KIYI–88-33
DE89617350	RAL–89-014
DE89617353	CNIC–00171
DE89617385	ANU-P–979
DE89617423	DOE-RW–89.023
DE89617425	SAAS–369
DE89617428	STRIPA-TR–88-03
DE89617451	INIS-GB–192
DE89617452	INIS-mf–11442
DE89617461	INIS-mf–11444
DE89617496	IFVE-OASU–88-91
DE89617497	KIYI–88-36
DE89617502	INIS-BR–1474
DE89617503	INIS-GB–187
DE89617504	INIS-mf–11441
DE89760575	CEA-CONF–9695
DE89760576	CEA-CONF–9694
DE89760613	CEA-CONF–9672
DE89760690	CEA-CONF–9702
DE89760705	CEA-CONF–9415
DE89760706	CEA-CONF–9436
DE89760707	CEA-CONF–9437
DE89764081	AFME–FR.17
DE89764822	SSI–88-21
DE89764823	SSI–88-07
DE89766237	ECN–215
DE89766836	NEI-DK–154
DE89766837	EEV–88-02
DE89766838	NEI-DK–155
DE89766839	NEI-DK–156
DE89766843	DTH-LET-RE–88-8
DE89766852	NEI-DK–158
DE89766853	NEI-DK–159
DE89766854	NEI-DK–160
DE89766863	NEI-DK–162
DE89766864	NEI-DK–163
DE89766865	NEI-DK–164
DE89766868	NEI-DK–166
DE89766872	STF–34A88072
DE89766873	NILU/OR–12/88
DE89766876	RF/PRC/T–7/86
DE89766877	STF–45A84002
DE89766878	STF–85037
DE89766884	NEI-NO–63
DE89766885	STEV-TB–89-1
DE89766886	STEV-TB–89-2
DE89766887	STEV-EO–89-1
DE89766888	STEV-EO–89-3
DE89766889	STEV-FBT–89-19
DE89766890	STEV-FBT–89-20
DE89766891	IVL-B–900
DE89766894	STU-I–671
DE89766895	STEV–1989-R1
DE89766896	SLU-LBT–63
DE89766897	SV-UL–1988-34
DE89766898	LITH-IKP-EX–680
DE89766899	LITH-IKP-EX–690
DE89766901	LRAP–68
DE89766904	STU–83-4640
DE89766907	STEV–1988-R15
DE89766909	IVL-B–916
DE89766910	IVL-B–871
DE89766911	SNV–3520
DE89766912	SNV–3552
DE89766913	SNV–3533
DE89766924	STEV-NYEL–89-1
DE89766926	STEV-EO–89-6
DE89766927	STEV-FGT–89-1
DE89766928	STEV-FJV–89-1
DE89766931	IVL-B–903
DE89766935	BFR-R–92-1988
DE89766977	IVO-A–03/88
DE89770502	CEA-CONF–9760
DE89770503	CEA-CONF–9761
DE89770506	CEA-CONF–9719
DE89770508	CEA-CONF–9759
DE89770509	CEA-CONF–9717
DE89770510	CEA-CONF–9639
DE89770511	CEA-CONF–9638
DE89770536	CEA-CONF–9758
DE89774564	NP–9774564
DE89774580	NP–9774580
DE89774597	KFK–4521
DE89774605	INIS-mf–11956
DE89774606	DFVLR-FB–87-29
DE89774607	INIS-mf–11955
DE89774608	INIS-mf–11954
DE89774609	INIS-mf–11953
DE89774615	Juel-Spez–472
DE89774667	IKE–2-84
DE89774668	KFK–4511
DE89774670	INIS-mf–11948
DE89774677	KFK–4524
DE89774678	INIS-mf–11939
DE89774679	INIS-mf–11938
DE89774680	Juel-Spez–480
DE89774711	GSI–89-23(prepr.)
DE89774712	GSI–89-24(prepr.)
DE89774713	INIS-mf–11949
DE89774714	GSI–89-31(prepr.)
DE89774715	GSI–89-30(prepr.)
DE89774739	Juel-Spez–464
DE89774741	HASYLAB–84-03
DE89774742	KFK–4508
DE89774744	Juel–2252
DE89774745	GSF–14/88
DE89774748	PTB-SE–7/2(rev.ed.)
DE89774749	KFK–4528
DE89774750	KFK–4529
DE89774751	KFK–4502
DE89774752	Juel–2235
DE89774794	INIS-mf–11959
DE89774795	INIS-mf–11958
DE89774817	Juel–2240
DE89774818	Juel–2222
DE89774819	Juel–2234
DE89774820	GSI–89-07
DE89774821	GSI–89-08
DE89774822	Juel–2243
DE89774824	GRS-F–171
DE89774833	ISI-A–10-387-0
DE89774848	NP–9774848
DE89775031	KU-HCOE-FL2-R–88-29
DE89775032	KU-HCOE-FL2-R–88-28
DE89775033	KU-HCOE-FL2-R–88-27
DE89775034	KU-HCOE-FL2-R–88-26
DE89775035	KU-HCOE-FL2-R–88-25
DE89775037	KU-HCOE-FL2-R–88-22
DE89775038	KU-HCOE-FL2-R–89-5
DE89775039	KU-HCOE-FL2-R–89-6
DE89775042	NBI-HE–89-06
DE89775043	NBI-HE–88-80
DE89775044	NBI-HE–89-01
DE89775045	NBI-HE–89-07
DE89775046	KU-HCOE-FL2-R–89-7
DE89775047	STRIPA–88-11
DE89775048	SKN–20
DE89775049	SKN–21
DE89775050	INIS-mf–11935
DE89776122	NEI-DK–168
DE89776133	DTH-LET-NE–88-1
DE89776134	NEI-DK–169
DE89776135	NEI-DK–170
DE89776136	DTH-AFM–88-12
DE89776137	NEI-DK–171
DE89776139	AUC-IBT-R–8806
DE89776140	NEI-DK–161
DE89776148	RISO-M–2765
DE89776149	RISO-M–2774
DE89776150	RISO-M–2718
DE89776151	RISO-R–545
DE89776152	NEI-DK–174
DE89776153	NEI-DK–173
DE89776159	NEI-DK–175
DE89776160	NEI-DK–176
DE89776420	LAL-RT–88-06
DE89776426	CRN-PN–83-22
DE89776427	CRN-PN–85-30
DE89776428	CRN-HE–86-09
DE89776430	CRN-PN–8630
DE89776431	LPNHE–8701

Order No.	*Report No.*
DE89776432	FRCEA-TH–84
DE89776433	CEA-CONF–9219
DE89776434	CRN-PN–86-26
DE89776435	LAL–88-53
DE89776437	LAL–88-21
DE89776439	CRN-PN–86-31
DE89776440	IPNO-DRE–88-04
DE89776467	DPHN–89-1
DE89776468	CEA-DAS–560
DE89776486	CEA-CONF–9628
DE89776487	CEA-CONF–9635
DE89776488	CRN-PN–88-24
DE89776489	IPNO-DRE–88-11
DE89776490	IPNO-DRE–88-12
DE89776491	LAPP-EXP–88-05
DE89776503	ESA-SP–281
TI89011053	NUREG/CP–0101
TI89011305	DOE/RW–0233
TI89011834	NUREG–0020-Vol.13-No.4
TI89012221	NUREG/CR–5274
TI89012363	NUREG/CR–5353
TI89012439	NUREG–0386-Digest-5-Rev.1
TI89012607	NUREG–0896-Suppl.8
TI89013272	NUREG–0540-Vol.2-No.3
TI89013312	NUREG/CR–5244
TI89013434	UT–9013434
TI89013606	NUREG/CR–5351

ORDER FORM

DOE and DOE contractors: Fill in Parts I, II, and IV. **Others:** Fill in Parts I, III, and IV. Mark appropriate blanks in Part IV to indicate quantity and form (microfiche or paper copy).

I. SHIPPING AND PAYMENT INFORMATION

Ordering Address

Name _____ Telephone _____

Address _____

City _____ State _____ ZIP _____

Shipping Address (if different from above)

Name _____

Address _____

City _____ State _____ ZIP _____

_____

SIGNATURE (Required to validate ALL orders)

II. OSTI ORDERS (DOE and DOE contractors can order from OSTI.)

☐ Charge OSTI deposit account no. _____

Mail orders to: U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

III. NTIS ORDERS

☐ Charge NTIS deposit account no. _____

☐ Check/Money Order enclosed for $ _____

☐ Charge to my ☐ American Express ☐ VISA ☐ MasterCard

_____ _____
Account Number Card expiration date

☐ Ship & Bill (see below for restrictions)

Employer identification number (9 digits) __ __ __ __ __ __ __ __ __

Purchase Order number _____

Phone number of billing office _____
(Required for Ship & Bill orders)

Ship & Bill service is restricted to North American business locations for an extra $7.50 per order (or per Custom Search). The business' employer identification number plus the phone number of the office paying the bill are required to process these requests. A late payment charge will be applied to billings more than 30 days overdue. Prepaying, using an NTIS Deposit Account or a charge account, speeds order processing. Be sure payment and order are sent together. Checks, payable to NTIS, must be in U.S. dollars.

Mail orders to: U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

IF NO METHOD OF PAYMENT IS INDICATED, YOUR ORDER WILL BE RETURNED TO YOU AS A PRICE QUOTE UNPROCESSED.

IV. SELECTIONS

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

_____ _____
Order number Report number

_____
Abstract number (with vol., issue)

_____ _____
No. of fiche No. of paper copies

CODES USED ON INDEX LINES

Following the citation numbers in the Corporate Author, Personal Author, and Subject Indexes, codes are used to designate the type of document, country of publication, and language of the document, e.g., (R;SU;RU). The language designator does not appear if the document is published in English.

DOCUMENT TYPES

J	Journal article
TJ	Translation of a journal article
R	Report
RA	Report analytic
B	Book
BA	Book analytic
P	Patent
E	Engineering materials
D	Dissertation
TG	Translation (general)
TA	Translation (analytic)

COUNTRY CODES

AD	Andorra
AE	United Arab Emirates
AF	Afghanistan
AL	Albania
AR	Argentina
AT	Austria
AU	Australia
BB	Barbados
BD	Bangladesh
BE	Belgium
BG	Bulgaria
BH	Bahrain
BI	Burundi
BJ	Benin
BM	Bermuda
BO	Bolivia
BR	Brazil
BS	Bahamas
BT	Bhutan
BU	Burma
BW	Botswana
BY	Byelorussian Soviet Socialist Republic (Byelorussian SSR)
CA	Canada
CB	Khmer Republic
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Ivory Coast
CL	Chile
CM	United Republic of Cameroon
CN	China
CO	Colombia
CR	Costa Rica
CS	Czechoslovakia
CU	Cuba
CY	Cyprus
DD	German Democratic Republic
DE	Germany, Federal Republic of (F.R. Germany)
DK	Denmark
DO	Dominican Republic
DZ	Algeria
EC	Ecuador
EG	Egypt
ES	Spain
ET	Ethiopia
FI	Finland
FJ	Fiji
FR	France
GA	Gabon
GB	United Kingdom of Great Britain and Northern Ireland (UK)
GD	Grenada
GH	Ghana
GM	Gambia
GN	Guinea
GQ	Equatorial Guinea
GR	Greece
GT	Guatemala
GU	Guam
GW	Guinea-Bissau
GY	Guyana
HK	Hong Kong
HN	Honduras
HT	Haiti
HU	Hungary
HV	Upper Volta
ID	Indonesia
IE	Ireland
IL	Israel
IN	India
IQ	Iraq
IR	Iran
IS	Iceland
IT	Italy
JM	Jamaica
JO	Jordan
JP	Japan
KE	Kenya
KH	Democratic Kampuchea
KP	Democratic People's Republic of Korea
KR	Korea, Republic of
KW	Kuwait
LA	Laos
LB	Lebanon
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LU	Luxembourg
LY	Libyan Arab Republic
MA	Morocco
MC	Monaco
MG	Madagascar
ML	Mali
MN	Mongolia
MR	Mauritania
MT	Malta

MU Mauritius
MV Maldives
MW Malawi
MX Mexico
MY Malaysia

NE Niger
NG Nigeria
NI Nicaragua
NL Netherlands
NO Norway
NP Nepal
NR Nauru
NZ New Zealand

OM Oman

PA Panama
PE Peru
PG Papua New Guinea
PH Philippines
PK Pakistan
PL Poland
PR Puerto Rico
PT Portugal
PY Paraguay

QA Qatar

RH Southern Rhodesia
RO Romania
RW Rwanda

SA Saudi Arabia
SD Sudan
SE Sweden
SG Singapore
SK Sikkim
SL Sierra Leone
SM San Marino
SN Senegal
SO Somalia
SU Union of Soviet Socialist Republics (USSR)
SV El Salvador
SY Syria
SZ Swaziland

TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VE Venezuela
VI Virgin Islands of the United States
VN Viet Nam

WS Western Samoa

YD Democratic Yemen
YE Yemen
YU Yugoslavia

ZA South Africa
ZM Zambia
ZR Zaire
ZW Zimbabwe

LANGUAGE CODES

BE Belorussian
BU Bulgarian
CH Chinese
CZ Czech
DA Danish
DU Dutch
FI Finnish
FL Flemish
FR French
GE German
HE Hebrew
HI Hindi
HU Hungarian
IR Iranian
IT Italian
JA Japanese
KO Korean
NO Norwegian
PO Polish
PT Portuguese
RN Rumanian
RU Russian
SC Serbo-Croatian
SE Slovene
SP Spanish
SV Slovak
SW Swedish
TH Thai
TU Turkish
UK Ukrainian
VT Vietnamese

☆U. S. GOVERNMENT PRINTING OFFICE: 1989/648–118/00007

CUT OUT APPROPRIATE FORM AND MAIL IN A STAMPED ENVELOPE TO THE ADDRESS INDICATED.

Change of Address Form

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

MAIL THIS FORM TO:

NEW ADDRESS
Superintendent of Documents
Government Printing Office SSOM
Washington, D.C. 20402

Attach last subscription label here

Subscription Order Form

Enter my Subscription to: _____

(Please indicate publication)

@ $_____ Domestic; @ $_____ Foreign.

NAME—FIRST, LAST

COMPANY NAME OR ADDITIONAL ADDRESS LINE

STREET ADDRESS

CITY | STATE | ZIP CODE

PLEASE PRINT OR TYPE

(or) COUNTRY

☐ Remittance Enclosed (Make checks payable to Superintendent of Documents)

☐ Charge to my Deposit Account No._____

MAIL ORDER FORM TO:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

Direct access to the world's most comprehensive energy data base

ONLINE

The Energy Data Base (EDB), produced by the Department of Energy, Office of Scientific and Technical Information (OSTI), is a computer-readable bibliographic data base containing citations, abstracts, and indexes to all types of domestic and foreign scientific and technical literature on energy, including energy sources, conservation, energy policy, advanced energy systems, environmental aspects of energy, and basic scientific studies in physics, chemistry, biology, and engineering. The EDB contains over 1,500,000 references from worldwide sources. It is updated bimonthly.

The complete data base is leased to two commercial on-line systems and is available on magnetic tape through the National Technical Information Service.

One year of EDB files is available to DOE and its contractors through the OSTI Automated Retrieval System (OARS). The OSTI Integrated Technical Information System (ITIS), which is a communication link to the on-line systems of OSTI and to commercial and other government on-line systems, provides a gateway through which EDB can be accessed by DOE and its contractors on the commercial systems also. Inquiries concerning access by this means should be addressed to:

U.S. Department of Energy
Office of Scientific and
Technical Information
P.O. Box 62
Oak Ridge, Tennessee 37831

EDB ON COMMERCIAL SYSTEMS

- *DIALOG Information Services, Inc.*
  3460 Hillview Avenue
  Palo Alto, California 94304
  Phone: (800) 334-2564

- *STN International*
  Chemical Abstracts Service
  2540 Olentangy River Road
  P. O. Box 3012
  Columbus, Ohio 43210
  Phone: (800) 848-6533
  Phone: (614) 421-3600

FEDERAL DEPOSITORY LIBRARY PROGRAM

As a result of an agreement between the U. S. Government Printing Office (GPO) and the Department of Energy, beginning in 1984 DOE reports with unlimited distribution are now included in the Federal Depository Library Program. The Regional Depository Libraries listed below receive and retain at least one copy of nearly every Federal Government publication, either in printed or microfilm form, for use by the general public. These libraries provide reference services and interlibrary loans; however, they are *not* sales outlets. You may wish to ask your local library to contact a Regional Depository to help you locate specific publications, or you may contact the Regional Depository yourself. Do not send checks or orders to these libraries.

ARKANSAS STATE LIBRARY
One Capitol Mall
Little Rock, AR 72201
(501) 371-2326

AUBURN UNIV. AT MONTGOMERY LIBRARY
Documents Department
Montgomery, AL 36193
(205) 279-9110, ext. 253

UNIV. OF ALABAMA LIBRARY
Documents Dept.-Box S
University, AL 35486
(205) 348-7369

DEPT. OF LIBRARY, ARCHIVES AND PUBLIC RECORDS
Third Floor-State Cap.
1700 West Washington
Phoenix, AZ 85007
(602) 255-4121

UNIVERSITY OF ARIZONA LIB.
Governments Documents Dept.
Tucson, AZ 85721
(602) 626-5233

CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 2037
Sacramento, CA 95809
(916) 322-4572

UNIV. OF COLORADO LIB.
Government Pub. Division
Campus Box 184
Boulder, CO 80309
(303) 492-8834

DENVER PUBLIC LIBRARY
Govt. Pub. Department
1357 Broadway
Denver, CO 80203
(303) 571-2131

CONNECTICUT STATE LIBRARY
Government Documents Unit
231 Capitol Avenue
Hartford, CT 06106
(203) 566-4971

UNIV. OF FLORIDA LIBRARIES
Library West
Documents Department
Gainesville, FL 32611
(904) 392-0367

UNIV. OF GEORGIA LIBRARIES
Government Reference Dept.
Athens, GA 30602
(404) 542-8951

UNIV. OF HAWAII LIBRARY
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230

UNIV. OF IDAHO LIBRARY
Documents Section
Moscow, ID 83843
(208) 885-6344

ILLINOIS STATE LIBRARY
Information Services Branch
Centennial Building
Springfield, IL 62706
(217) 782-5185

INDIANA STATE LIBRARY
Serials Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3686

UNIV. OF IOWA LIBRARIES
Govt. Documents Department
Iowa City, IA 52242
(319) 353-3318

UNIVERSITY OF KANSAS
Doc. Collect.-Spencer Lib.
Lawrence, KS 66045
(913) 864-4662

UNIV. OF KENTUCKY LIBRARIES
Govt. Pub. Department
Lexington, KY 40506
(606) 257-3139

LOUISIANA STATE UNIVERSITY
Middleton Library
Govt. Docs. Dept.
Baton Rouge, LA 70803
(504) 388-2570

LOUISIANA TECHNICAL UNIV. LIBRARY
Documents Department
Ruston, LA 71272
(318) 257-4962

UNIVERSITY OF MAINE
Raymond H. Fogler Library
Tri-State Regional Documents Depository
Orono, ME 04469
(207) 581-1680

UNIVERSITY OF MARYLAND
McKeldin Lib.-Doc. Div.
College Park, MD 20742
(301) 454-3034

BOSTON PUBLIC LIBRARY
Government Docs. Dept.
Boston, MA 02117
(617) 536-5400 ext. 226

DETROIT PUBLIC LIBRARY
Sociology Department
5201 Woodward Avenue
Detroit, MI 48202
(313) 833-1409

MICHIGAN STATE LIBRARY
P.O. Box 30007
Lansing, MI 48909
(517) 373-0640

UNIVERSITY OF MINNESOTA
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7813

UNIV. OF MISSISSIPPI LIB.
Documents Department
University, MS 38677
(601) 232-5857

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA LIBRARY COMM.
Federal Documents
1420 P Street
Lincoln, NE 68508
(402) 471-2045
(in cooperation with University of Nebraska-Lincoln)

UNIVERSITY OF NEVADA LIB.
Govt. Pub. Department
Reno, NV 89557
(702) 784-6579

NEWARK PUBLIC LIBRARY
5 Washington Street
Newark, NJ 07101
(201) 733-7812

UNIVERSITY OF NEW MEXICO
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-2033, ext. 22

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Wilson Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1321

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-2617, ext. 27
(in cooperation with North Dakota State Univ. Library)

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43215
(614) 462-7051

OKLAHOMA DEPT. OF LIBRARIES
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927-Cap. Sta.
Austin, TX 78753
(512) 471-2996

TEXAS TECH. UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

UNIVERSITY OF VIRGINIA
Alderman Lib.-Public Doc.
Charlottesville, VA 22901
(804) 924-3133

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506
(304) 293-3640

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3000

ST. HIST. LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
(307) 777-6344

Order Number Correlation
Report Number Index
Contract Number Index
Subject Index
Personal Author Index
Corporate Author Index